VOLUME 40
NUMBER 4

APRIL, 1953

plating

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CHROMIC ACID MANUFACTURE

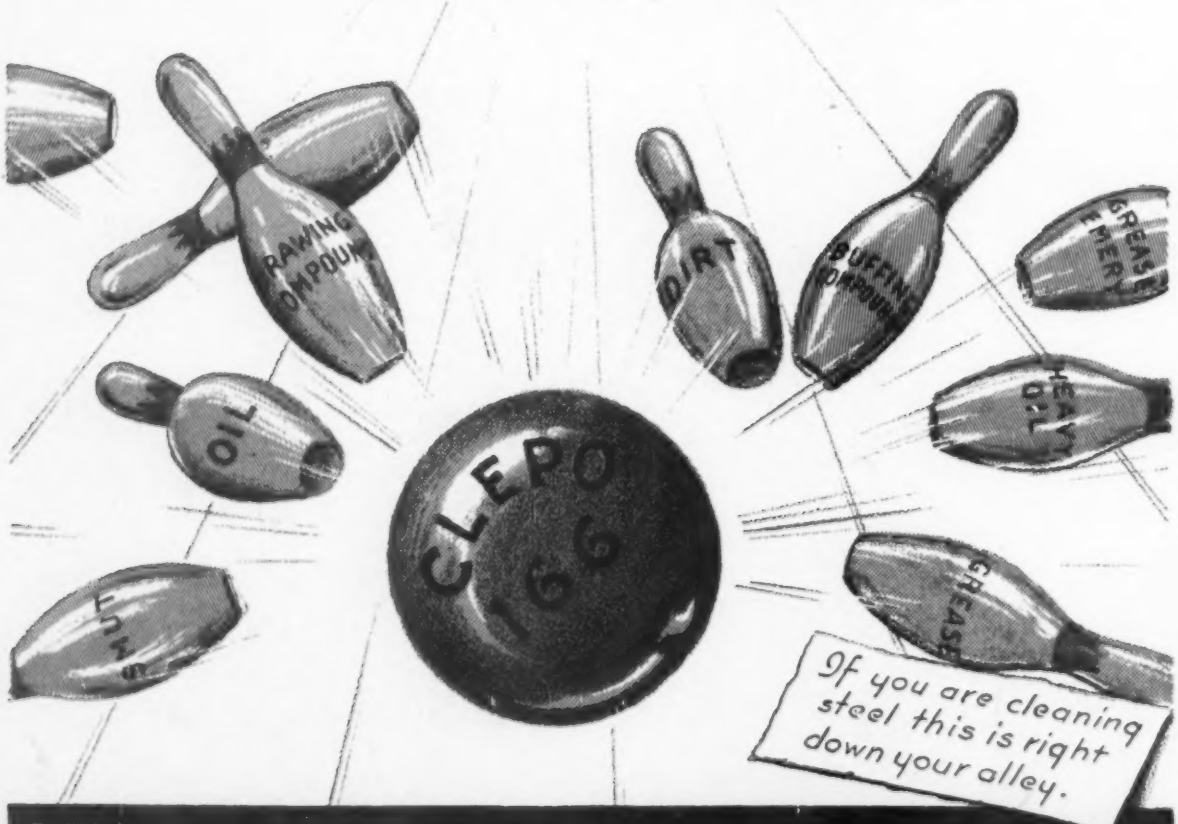
See Contents Page 361

The All Purpose Steel Electrocleaner

CLEPO 166

a Strike

Clepo 166 bowls them all over
The heavy duty steel Electrocleaner
for removing light and heavy oil,
smut, buffing compound, grease
emery, and drawing compound.



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Remove Grease and Grime in Seconds with ENTHONE *Emulsion Cleaner* 75

Heavy oil films and solid dirt are removed from steel almost instantly.

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Insures smoother, brighter, more adherent electrodeposits.

Used before phosphate coatings it minimizes coarse coatings.

Safe for operators, does not irritate nose, throat or skin.

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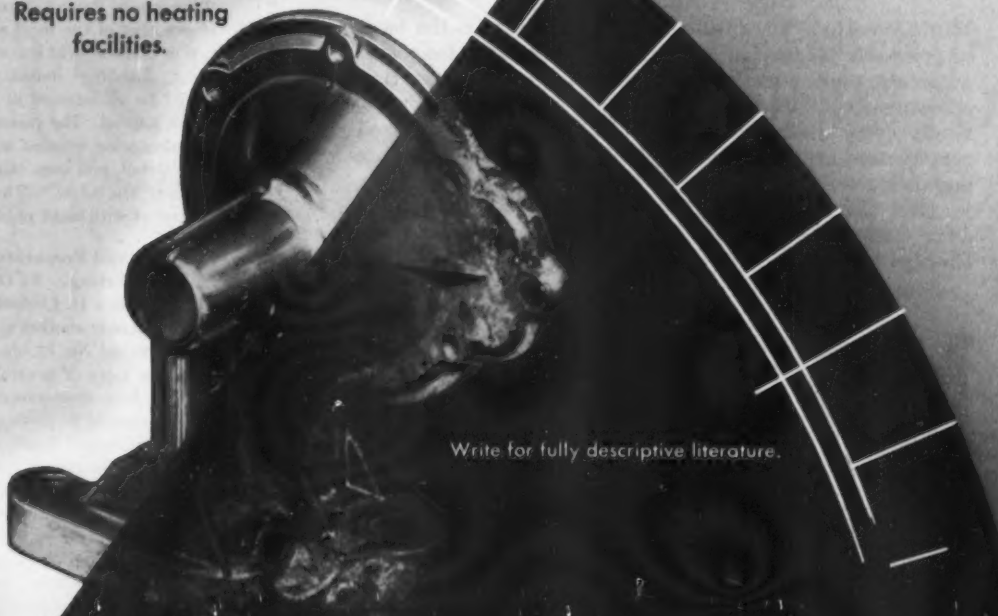

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Mechanized handling in the different sequences is the basis of profitable production plating. In the MEAKER designs of automatic plating machines this handling is flexible so that adjustments and modifications are easily made to meet practically every plating requirement. Too, the simple rugged construction insures uninterrupted schedules and minimum maintenance costs.

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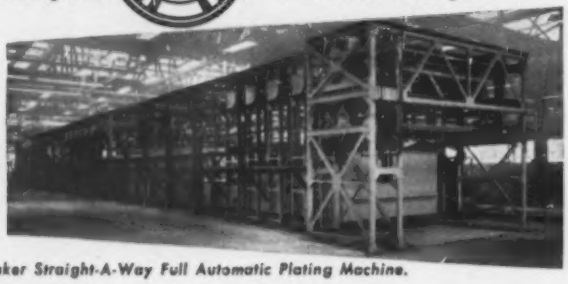


A Meaker Straight-A-Way Full Automatic Plating Machine.

In This Issue

"Why" As Applied to Cyanide Zinc Plating by Thomas J. Menzel is a practical paper on the subject of zinc plating troubles and cures. It is a review of the author's experiences told in a question-and-answer style in which he lists causes and cures for dull, rough, thin and blistered zinc deposits.

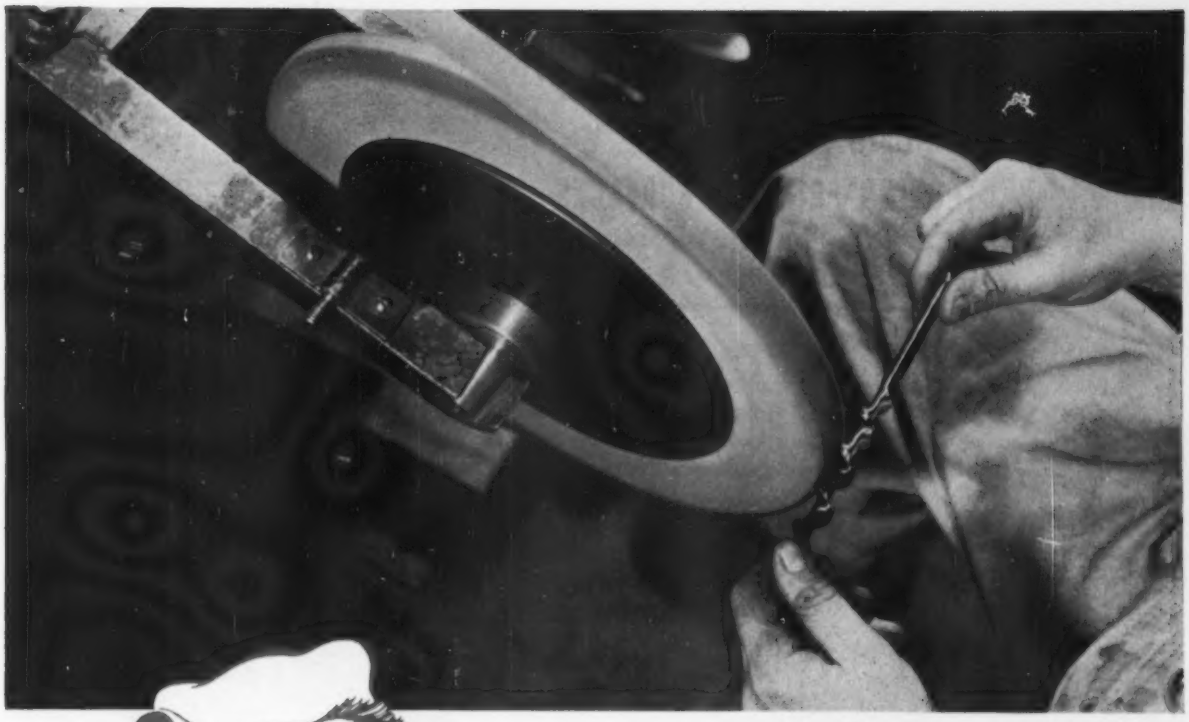
Radioactive Tracers Track Metal Cleaner Effectiveness by J. W. Hensley is a story on the radioactive tagging of fatty acid type soils as a step in the determination of basic data on the metal cleaning operation and cleaner effectiveness. The method is sensitive and versatile, and though still a laboratory tool, indications are that it may be adapted for practical use in the plating shop when data on shop variables are more complete. Included in the paper are five illustrations.

Chromic Acid Manufacture by Eugene L. Combs is a general interest story that traces the manufacture of chromic acid from the original Transvaal ore through the grinding, roasting, leaching, bichromate crystallization, and chromic acid flaking steps. Since about 70 per cent of the total annual production of chromic acid is consumed by the metal finishing industry, the story should be of interest to many readers of this journal. The various steps in the manufacturing process are outlined in some detail, and uses other than metal finishing are listed. The story is well illustrated with eight photographs.

Cleaning and Preparation of Metals for Electroplating. V. Oil Spreading Rates by Henry B. Linford and Edward B. Saubestre is another report from Research Project No. 12. In the study the spreading rates of several oils on steel surfaces were determined. Oils which adsorb strongly to clean surfaces (e. g., oleic acid) spread least; non-adsorbing oils (e. g., mineral oil) spread rapidly. Fatty oils (e. g., lard oil) are intermediate in behavior. Spreading rates are higher on matte surfaces than on polished surfaces. Cleaning index values, obtained in a previous study, for the waterbreak and atomizer tests are corrected for oil spreading effects. The paper is illustrated with ten figures and seven tables.

For page numbers, see Table of Contents, page 361

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Subscriptions: Domestic and Canada. $4.00 for 1 year, $7.00 for 2 years 50c per copy; Foreign, $6.00 per year, $1.00 per copy.



"IF IT'S POLISHING, LET ME DO THE EXPERIMENTING" SAYS POLISHER PETE

You may hit it in one — then again you may make many tries for the most profitable polishing method, get only a mediocre result. Consider the many variables in this polishing game — here are some:

2 Types of electric-furnace abrasive grain —
19 Sizes of abrasive grain —
9 Types of belt —

Over 15 types of contact wheels and that's only part of it — right there, are over thousands of possible combinations. Why waste good production time on hit-or-miss research when Polisher Pete has already gone over the ground and has your answer ready for you?

Polisher Pete symbolizes the BEHR-MANNING® Engineering Application Department, and the staff of BEHR-MANNING Abrasive Engineers, with this polishing data right at their finger tips, is all set to cooperate. Even if you *know* you are getting best results, why not confirm it. Call in your local BEHR-MANNING Field Engineer and make a double-check.

For some pretty solid facts on polishing, write for the booklet, "How Polisher Pete Put Economy in Polishing." Behr-Manning Corp., Troy, N. Y., Dept. PL-4

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Technical Service Data Sheet
Subject: PROTECTING FRICTION SURFACES
WITH THERMOIL-GRANODINE®

INTRODUCTION

Fabricators and product designers, particularly in the automotive field, are aware that even highly polished surfaces under friction weld, gall and score. One of the most inexpensive and practical methods of preventing this is to coat the metal to prevent metal-to-metal contact. With cast iron or steel, the "Thermoil-Granodine" manganese-iron phosphate coating provides a wear-resistant layer of unusual effectiveness.

Thermoil-Granodizing greatly prolongs the life of parts subject to friction. It protects the surface of products like the diesel engine liners shown above and the many moving parts of automobiles and other machines. "Thermoil-Granodine" with its remarkable lubricating properties is particularly valuable in these and similar applications because of its ability to retain oil and maintain lubrication under high pressures and high velocities. This ACP wear-proofing chemical not only permits rapid break-in without scoring, scuffing and welding but also reduces subsequent wear on friction parts.

"THERMOIL-GRANODINE" PROTECTS RUBBING PARTS

Thermoil-Granodizing removes "fuzz" from ferrous metal friction surfaces and produces a coating of non-metallic, water-insoluble manganese-iron phosphate crystals which soak up and hold oil as bare untreated metal cannot do. The oiled crystalline "Thermoil-Granodine" coating on piston rings, pistons, cylinders, cylinder liners, cranks, cam-shafts, gears, tappets, valves, spiders and other rubbing parts, allows safe break-in operation, eliminates metal-to-metal contact, maintains lubrication and reduces the danger of scuffing, scoring, welding, galling and tearing of the metal. The work to be protectively treated is merely Thermoil-Granodized and oiled, usually with a soluble oil.

"THERMOIL-GRANODINE" MEETS THESE SPECIFICATIONS

SPECIFICATION NUMBER	SPECIFICATION TITLE
MIL-C-16232 Type I	Coatings — phosphate; oiled, slushed, or waxed (for ferrous metal surfaces) and phosphate treating compounds.
AN-F-20 (See also U.S.A. 3-213)	Finishes, for electronic equipment.
U.S.A. 57-0-2C Type II, Class A	Finishes, protective, for iron and steel parts.
U.S.A. 51-70-1 Finish 22.02, Class A	Painting and finishing of fire control instruments; general specification for
M-364	Navy aeronautical process specification for compound phosphate rust-proofing process.

CHEMICALS ACP PROCESSES

WRITE FOR FURTHER INFORMATION ON "THERMOIL-GRANODINE" AND ON YOUR OWN METAL PROTECTION PROBLEMS.

CHEMICALS ACP PROCESSES

Industry News

New Naraco Plant in California. Naraco has opened a new plant at 3462 San Fernando Rd., Los Angeles, Calif. This new addition to Naraco's family of five will be known as The Industrial Rack Company. The other factories are The American Rack of Cicero, Ill., The National Rack, having two plants in Paterson, N. J., and the two plants of Imperial Plating Rack Company of Flint and Hazel Park, Mich.

The Industrial Rack building houses Executive offices and a section for the engineering staff and research development units. Mr. William Zube, former president of Naraco's Cicero, Ill., plant, has been appointed President of Industrial Rack.

Caltech Appoints Dr. Beckman Trustee. Dr. Arnold O. Beckman, president and founder of Beckman Instruments, Inc., was one of the two men appointed recently to the Board of Trustees of the California Institute of Technology at Pasadena.

An Institute Associate since 1948, Dr. Beckman is the first alumnus elected as trustee. He received his doctorate in chemistry from the Institute in 1928 and served on the faculty from 1929 to 1940, leaving to enter the field of precision instrument manufacturing.

New Quarters for Grieve-Hendry Company. Grieve-Hendry Company, Inc., manufacturers of a standard line and custom-built industrial ovens, has moved to a larger modern factory at 1811–1819 W. Lake St., Chicago 12, Ill. Manufacturing and production have been expanded considerably to take care of increased demand. New facilities provide for expediting quotations and delivery on standard ovens as well as on ovens built to meet particular requirements.

SALES

Foreman plater—experienced with copper, nickel, chromium, zinc, cadmium, tin and silver in manual, automatic and barrel equipment as well as anodizing and etching of aluminum—desires sales or production position. Available at once. *Reply to:*

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REMEMBER..... RAPID ELECTRIC CO. MEANS *"More power to You!"*

Industry News

New Electrofilm Licensee. The Keystone Chromium Corporation of Buffalo, N. Y., has been licensed as a custom processing plant for the Electrofilm Lubelok process in the Buffalo area. In addition to the service offered on the Electrofilm process the company also has complete facilities for electro-plating, rust proofing and metal finishing.

New Steel Shot Plant. American Wheelabrator & Equipment Corporation, Mishawaka, Ind., has just completed construction of a new plant specially designed for the manufacture of a new blast cleaning abrasive produced under the Company's patented process. The plant, now in operation, is the largest of its kind in the world, is completely mechanized and is equipped with electric melting furnaces and automatically controlled heat treating equipment to assure constant uniformity of product.

New Representatives for Atlas Mineral Products Company. Atlas Mineral Products Company announces the appointment of the following firms as representatives for their new Ampcoflex Division: Air, Dust & Fume Control Co., 50 Church St., New York 7, N. Y., and 972 Broad St., Newark 2, N. J.; E. J. Becker Co., 2832 E. Grand Blvd., Detroit 11, Mich.; Arthur C. Beckert, 21 Berger Rd., Saginaw, W. S., Mich.; Coward-Eastman Co., 43 S. 23rd St., Philadelphia, Pa.; H. M. Curfman Co., 20 W. 9th St. Bldg., Kansas City 6, Mo.; Robert D. Moyer, Sibley Tower Bldg., Rochester 4, N. Y.; J. M. Pettingell Assoc., 201 Devonshire St., Boston 10, Mass.; Robert B. Taylor, 966 Broadway, Albany 4, N. Y., and Wallin Engineering Sales Co., 916 S. Michigan Ave., Chicago, Ill.

L. T. Prince, technical service representative of Oakite Products, Inc., being presented with the D. C. Ball Award for Distinguished Service by John A. Carter, Oakite president. The award, in the form of a bronze plaque, is presented annually to the member of the firm's nationwide field organization adjudged to have rendered the most outstanding service to industry during the year

Foxboro's New Kansas Branch. The Foxboro Company, Foxboro, Mass., has opened a new branch office at Wichita to serve instrument users in the Kansas area. Appointed resident engineer at the Wichita Office located at 2207 S. Pinecrest, is Mr. Dale G. Hugley, who moves to his new assignment after several years of service with the Tulsa Branch as Industrial Engineer.

Division Lead Buys Eagle-Picher Metallic Products Division. The Division Lead Company, 836 W. Kinzie St., Chicago, announced the purchase of the Eagle-Picher Company Metallic Products Division plant at Argo, Ill. Equip-

DEVELOPMENT CHEMIST

Work on development of process for electro plating bright nickel and coating aluminum. Work on various research developments, including new plating procedures, especially on copper, nickel, iron, and zinc. BS degree preferred, advance training MS or higher in physical chemistry. • • • • • •

Reply to:

P-453-B, PLATING
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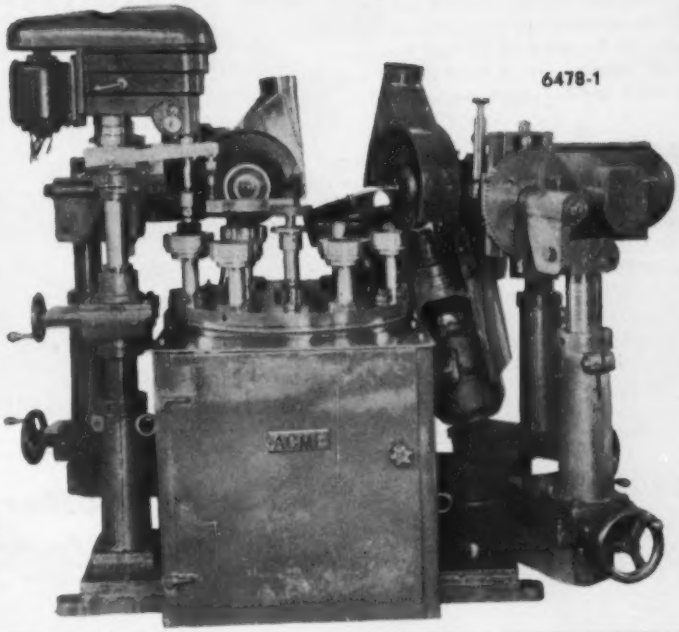
ACME *Rotaries* CUT FINISHING COSTS!

The photograph at right shows an ACME 30-inch, six-station Indexing Rotary with three standard ACME type G-3 polishing and buffing lathes and one special drill head. Used for wire brushing ID, OD and top surface of electric motor rotors simultaneously.

ACME Rotary Automatic Polishing and Buffing Machines are available in Indexing or Continuous types with tables from 18″ to 10′ diameter. These machines cut finishing costs on a wide variety of parts.



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Meet Production Schedules with ACME *Automatics!*

Acme Automatic Polishing and Buffing Machines provide a dependable solution to the problem of maintaining high civilian or defense production schedules at minimum unit costs. These highly efficient machines are available in types to handle parts of virtually any size or shape, with a wide variety of arrangements and accessory equipment to meet the specific finishing requirements. Problems of polishing, buffing, grinding, wire brushing, de-burring and Micro-finishing are effectively solved by Acme Automatics.

For recommendations, send blue prints of part or samples before and after finishing, together with detailed information on finishing operations and production requirements. If production methods will cut your costs, we can set your job up in our experimental processing department and you can inspect the machines in operation.

ROTARY STRAIGHT LINE SEMI-AUTOMATIC AND SPECIAL *Polishing and Buffing Machinery*

SPECIAL MACHINERY AMC AUTOMATIC BUFFING MACHINES

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Industry News

ment and personnel of the Metallic Products Division will be retained and immediately absorbed into the combined operation. In the plans of the new operation is the enlargement of their line of lead products and industrial chemicals.

Edco-Sintering Machinery Merger. Sintering Machinery Corporation, Netcong, N. J., and Equipment Development Company, Inc., Montclair, N. J., announce that an agreement has been concluded between the two companies for the development, manufacture and sale of a complete line of filtration equipment to be marketed under the trade name of "Edco-Sintering".

Under the agreement, Sintering Machinery Corporation will manufacture and stock filtration units and parts and Equipment Development Company, Inc., will design, engineer and sell the "Edco-Sintering" line.

Beckman Breaks Ground for Two Million Dollar Factory. Arnold O. Beckman, President and Founder of Beckman Instruments, Inc., officially broke ground recently with the traditional gold-plated shovel for a new two million dollar, 200,000 square foot instrument factory and administrative offices building.

Radio Active Tracers To Study Cleaners. The Diversey Corporation announces its entry into the field of applied nuclear research to develop new and improved prefinishing cleaners as well as new type protective and decorative coatings for the metal industry. The purchase of radio active isotopes from the government's atomic pile and the necessary equipment for measuring their presence and radiation will be employed to test effectiveness and behavior of metal cleaners. Apart from using radio active materials to determine the soil removing effectiveness of cleaners prior to electroplating, the new research technique is expected to successfully solve such problems as determining corrosion or absorption of inhibitive chemicals on metal and the effect of impurities in plating solutions.

Photo shows Rosemary Annos and Leslie Alt, of The Diversey Corporation's laboratories, taking the count per minute of a radioactive sample from the nuclear scaling unit at left. On the right is a count rate meter which serves as a monitor and a rate meter. This is part of the equipment Diversey will use in the field of applied nuclear research for the metal industry

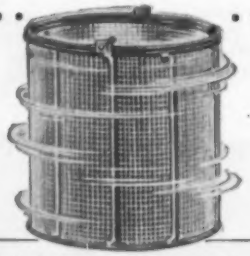
Pfaudler Moves Philadelphia Office. The Pfaudler Company, engineers and fabricators of corrosion resistant process equipment, has moved its Philadelphia office from 1213 Commercial Trust Building to 29 Bala Ave., Bala Cynwyd, Pa.

DRIES SMALL PARTS Faster–Better...

DOES IT FOR LESS!

Kreider Dryer with auxiliary gas heating unit (illustrated). Auxiliary steam heating unit available; also standard model without auxiliary heating.

Basket (shown below). Heavy gauge steel woven mesh over steel frame. Capacity, 1140 cu. ins.



Spin-Dries* up to 50 pounds in less than 2 minutes

Simple design . . . careful engineering, sturdy construction assure trouble-free, low-cost maintenance operation. Operates at 625 r.p.m. on less than 1 h.p.

No scarring or marring . . . with Kreider Dryer. Centrifugal force holds parts immovable in basket . . . assures smooth, evenly dried surfaces, long-lasting luster, minimum "rejects".

One man runs it! Standard model Kreider Dryer occupies less than 6 sq. ft. floor space. One man tends—loads, unloads—keeps production moving, prevents expensive, time-wasting tie-ups.

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New Holland Machine Co., New Holland, Pa.

***Only 2 simple steps required...**

(1) Operator places wire mesh basketful of small parts in Dryer . . . turns motor "ON."

(2) Operator turns motor "OFF" . . . presses foot brake . . . removes basket.

NEW HOLLAND *KREIDER* DRYER

Well established plating supply firm has territories open for sales representatives in Detroit, Chicago, Cleveland, Los Angeles, Houston and St. Louis. Apply in confidence. *Reply to:*

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R. O. HULL & COMPANY, INC.

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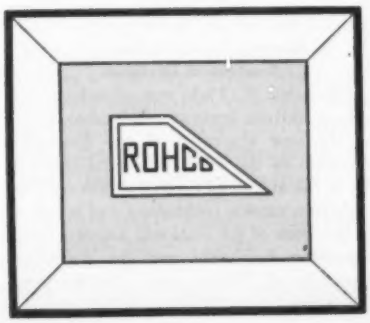

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Please send details on ROHCO 100 BARREL ZINC BRIGHTENER!

Name..... Title.....
Company.....
Street Address.....
City..... Zone..... State.....

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INDUSTRIAL Filters

BONUS PERFORMANCE
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The engineering and construction features of INDUSTRIAL filters add up to maximum clear filtrate with less floor space, greater operating conveniences, and less maintenance delays and expense. The general design permits the use of the materials best suited to the solution requirements. Vertical filter leaves with ample flow space on both sides offer maximum filtration area. Outside lockup simplifies the installation of filter leaf and bag assemblies. An exclusive air-wash cleaning method practically eliminates the usual labor and inconvenience of dismantling the filter after every cycle. INDUSTRIAL filters are often in operation for months without removing the cover — cutting downtime to a minimum. All these features have been proved in long-life service — your assurance of dependable bonus performance.

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DEMINERALIZERS
RUBBER LININGS
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HEAT EXCHANGERS

Society News

Masters' Electroplating Association

The response by suppliers, friends, and Association Members to the 35th Annual Banquet has been overwhelming. In order to insure that all guests will be accommodated a new date and a new location has been selected. The Banquet will be held at:

THE WALDORF ASTORIA
STARLIGHT ROOF
SATURDAY, MAY 9, 1953

Society of Plastics Engineers

Speaking at the ninth annual technical conference of the Society of Plastics Engineers, Harold Narcus of Electrochemical Industries, Inc., stated that metallized plastics offer many distinct advantages that in the future will ensure the greatly increased use of these materials. The output of metallized plastics, in the meantime, continued in a sharp upward swing with production amounting to an estimated 50 million pieces in 1952—a figure that is expected to rise to 100 million pieces in 1953. In his talk, Narcus detailed three basic methods for the plating of plastics as (1) chemical reduction, (2) mirror spray and (3) metal evaporation.

I. M. F. Organic Finishing Group

The Institute of Metal Finishing held an inaugural meeting of the newly formed Organic Finishing Group at the Charing Cross Hotel on March 19. The program included technical papers followed by a discussion period.

The Plating Institute of Michigan

At their recent Annual Meeting The Plating Institute of Michigan elected the following: President, Glenn H. Friedt, Jr., United Platers, Inc.; Vice-President, Howard E. Morse, Jr., Northeastern Plating Company; Treasurer, William Savin, Harding Manufacturing Company, Inc.; and Executive Secretary, James D. Mueller. Elected to the Board of Directors, in addition to the above officers, were Hugh Barron, Industrial Stamping Division of Vinco Corporation; Louis S. Morse, Jr., Detroit Plating Industries, and Gerald Burgess, Electroplating Service, Inc.

Electrochemical Society, Corrosion Division

Frederick W. Fink, corrosion technologist at Battelle Institute, Columbus, Ohio, is the new chairman of the Corrosion Division of the Electrochemical Society. He is the author of several papers on subjects in corrosion technology and is active in the work of the National Association of Corrosion Engineers and the American Institute of Mining and Metallurgical Engineers.

The Answer to your toughest tank lining problems

TYGON

flexible – plastic

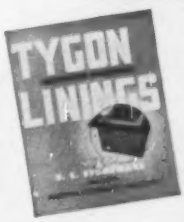
TOPS IN CORROSION-RESISTANCE

PROVEN in hundreds of the toughest possible applications during the past fourteen years, flexible Tygon plastic linings offer more value today than ever before.

Greater toughness — more stability — even longer life. These improved performance characteristics stem from improved manufacturing techniques, resulting in a denser, more homogeneous body. Top quality yesterday, Tygon is an even better material today.

And along with improved quality — application methods have been simplified. Application is no longer a "factory" must. Strategically located Tygon licensed applicators can now install Tygon linings quickly and economically. Coupled with lower applied costs are important savings in freight costs — and vitally important savings in time.

For that next "tough" tank lining problem — ask for, insist on — Tygon.



This new booklet tells the "down-to-earth" facts about Tygon. Where and how to use it. When not to use it. A valuable reference for every engineer faced with corrosion problems. Free on request. Write for your copy today!

Address: Plastics & Synthetics Division, The U. S. Stoneware Co., Akron 9, Ohio.

U. S. STONEWARE

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UDYLITE FULL AUTOMATIC CROSSES OFF REJECTS . . .

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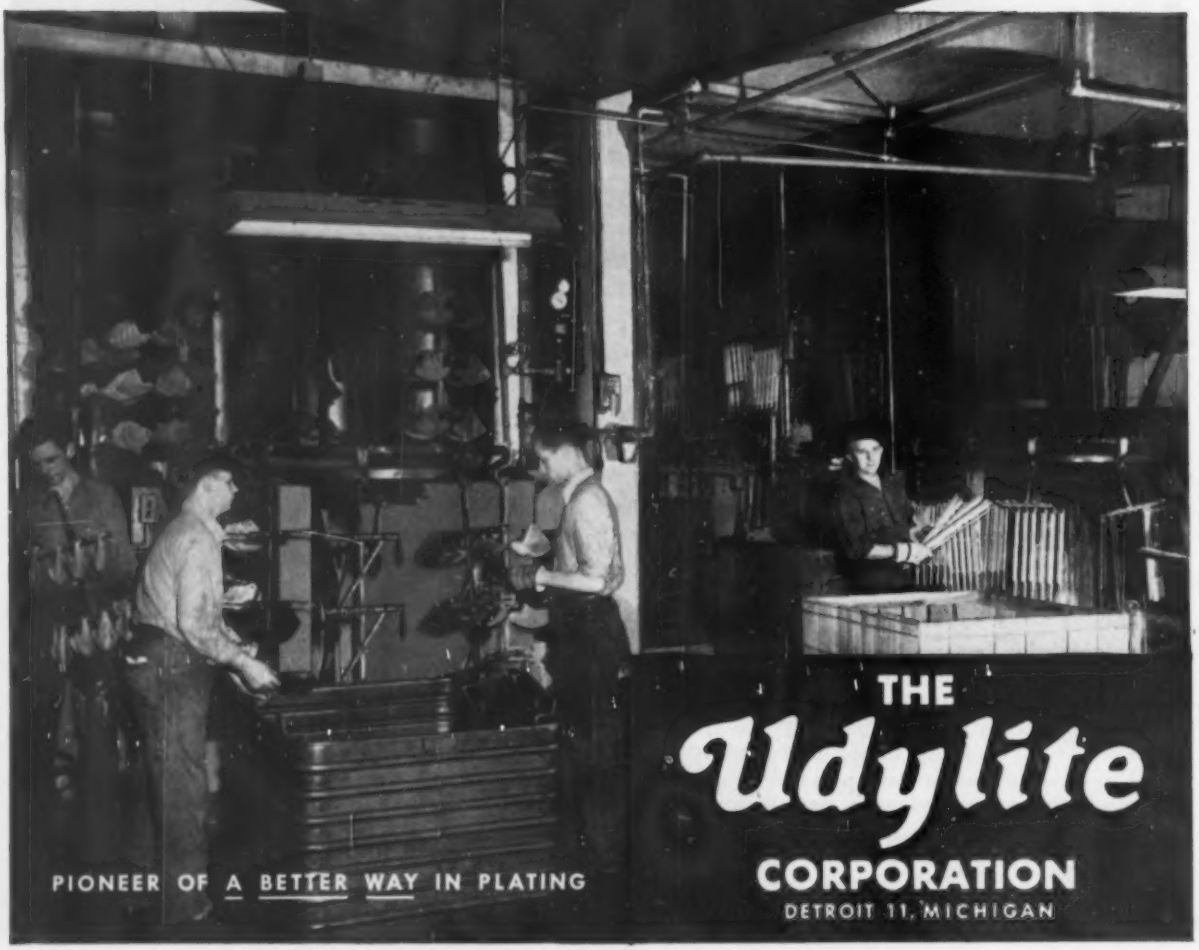
"Thousands and thousands of window regulators for automobiles go through the Dura Company Zinc Plating installation. Our Udylite Full Automatic practically eliminates rejects."

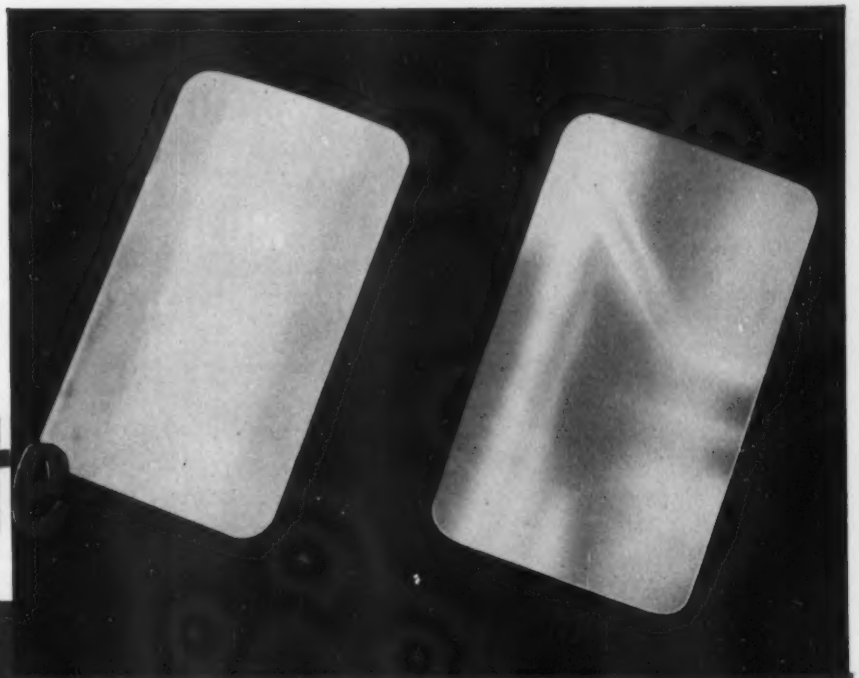
But that's only part of the Dura Company story. With their Udylite Full Automatic they get high production runs, too. This means a quality product at rock-bottom cost. It's easy to see that Udylite equipment is paying off for this modern, progressive company.

Why not bring YOUR plating problem to Udylite. Let us show you how Udylite equipment, research and supplies can give YOU top results. Call your Udylite technical man today or write direct. There's no obligation. THE UDYLITE CORPORATION, DETROIT 11, MICH.



PIONEER OF A BETTER WAY IN PLATING

THE *Udylite* CORPORATION
DETROIT 11, MICHIGAN



Udylite

BRIGHT ZINC PROCESS IS *really* BRIGHT!

The picture tells the story. It's easy to see the difference! Eye appeal . . . buy appeal . . . for the products YOU make can be vastly increased.

An extremely *bright* finish which is *economical* and *quick* is assured with Udylite Bright Zinc Process. Complicated parts with deep recesses or low current density areas can be plated bright with this process. And here's the best part of all! Only one paste brightener is required for the whole process. This makes it a very simple and easy operation.

Udylite automatic zinc plating installation at Dura Company of Toledo.

Udylite furnishes a complete line of zinc plating supplies —anodes, containers, processes. If you have a zinc plating problem, call your Udylite technical man today. He'll give you the entire story. Or, write direct to THE UDYLITE CORPORATION, DETROIT 11, MICHIGAN.

PIONEER OF A BETTER WAY IN PLATING

THE *Udylite* CORPORATION
DETROIT 11, MICHIGAN

Are you SURE you're using THE MOST EFFICIENT FINISH?

If your production involves finishing zinc, cadmium, aluminum or cuprous metals, you owe it to yourself . . . and your customers . . . to investigate

IRIDITE®

for on any of these metals Iridite gives you a high performance finish at a low cost from a simple chemical dip.

IF YOU WANT HIGH CORROSION RESISTANCE,
you'll find an Iridite that will meet any military or civilian specifications for chromate finishing.

IF PAINT ADHERENCE IS IMPORTANT,
you'll find Iridite prevents underfilm corrosion and soap formation.

OR, FOR BRIGHT, DECORATIVE FINISHES—

investigate zinc plate and Iridite (Bright) for a chrome-like decorative finish with more corrosion protection than conventional chrome plating . . . or Iridite (Metcote) as a treatment for copper that eliminates the need for buffing in the copper-chrome system; produces a sparkling bright finish!

Write for literature and send us samples for test processing. See "Plating Supplies" in your classified telephone directory or write direct.

Iridite is approved under government specifications.

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD

Manufacturers of Iridite Finishes for Cadmium, Protective and Paint Systems on Non-Ferrous Metals; ASP Plating Brighteners.

Personals

George Schore has recently joined the staff of the Frederick Gumm Chemical Company of Kearny, N. J., as technical sales representative.

Schore

Mr. Schore, who graduated from the College of the City of New York, as a Bachelor of Science in Chemical Engineering has been superintendent of many of the large finishing plants in the metropolitan area. For many years, he has been active in the American Electroplaters' Society and will be General Chairman of the Annual Convention to be held in New York in 1954.

His duties at Frederick Gumm Chemical Company will include the engineering and layout of plating, polishing and spraying plants, and the sale of equipment and supplies to the finishing industry.

Philip Ranno, of the Imperial Plating Company in Brooklyn, N. Y., was elected chairman of the Masters' Electro-Plating Association at the annual meeting of the

Ranno

Executive Committee. Phil, who is now also serving a term as President of the National Federation of Metal Finishers, has been in the plating business for 23 years.

In 1930, when he was sixteen, he joined the Company founded by his father, **Mr. Barney Ranno,** in 1910. Later he attended C. C. N. Y. and Columbia University; and also studied electro-plating under Drs. L. C. Pan and C. B. F. Young.

P. H. Richey has been elected as assistant treasurer and **F. J. Chmielnicki** as assistant secretary of Detrex Corporation, Detroit.

Mr. Richey, a graduate of the Univer-

The object of this little lesson in arithmetic is to prove that there are more ways than one to come to a conclusion. But, when it narrows down to Rectifiers, there is only one conclusion you can make. And that is... Green Rectifiers are unbeatable for quality, performance, and service.

IF YOU WANT THE BEST... Buy Green!

W. GREEN ELECTRIC COMPANY, INC.

SELECTRO PLATERS AND ALL TYPES OF RECTIFIER EQUIPMENT

GREEN EXCHANGE BUILDING 130 CEDAR STREET NEW YORK 6, N.Y.

RECTIFIER (G) ENGINEERS

REPRESENTATIVES:

- Walter R. Bimel, Indianapolis
- Cowan Electrical & Supply Co., Chicago
- Industrial Chemical & Supply Co., Minneapolis
- Manning & Manning, Newark
- Weaver Equipment & Supply Co., Houston
- W. M. Fortenbaugh, Buffalo

BRIGHTER

Barrel Nickel Plating

with TRUE BRITE NICKEL BRIGHTENER

Increase Production —
easy to control . . . cuts down on trouble that entails costly delays.

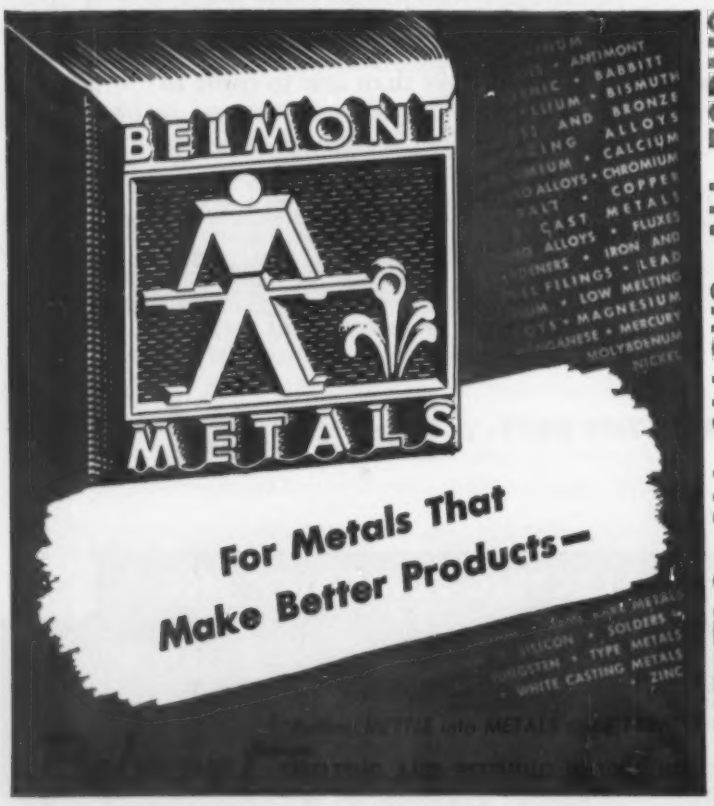
Save time —
can be operated at a higher speed.

Reduce Rejects —
gives unbelievable uniformity of deposit in recesses . . . brighter, whiter color.

Write for **FREE** *bulletin revealing tricks on improving your nickel plating and cutting costs.*

TRUE BRITE CHEMICAL PRODUCTS CO.
P. O. Box 31, Oakville, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 415.



Personals

sity of Michigan, has been associated with Detrex since 1948.

Mr. Chmielnicki, a graduate of the University of Detroit, has been with the company for 11 years as counsel and as head of their Legal Department.

Larry Glynn, Henry Pfeuffer and **Herb Marx** have been assigned as sales representatives by Wagner Brothers, Inc., to service the Eastern Michigan territory, which includes Detroit and Toledo.

Glynn

Pfeuffer

Marx

The new men, who will locate at the home office, 400 Midland Ave., Detroit 3, Mich., have had wide experience in production plating with leading firms in the territory they will service. Glynn and Pfeuffer have extensive chemical engineering and sales backgrounds. Marx has been in mechanical sales engineering.

Henry S. Elder, who has served as Vice-President of Titeflex since joining the company in 1946, has been promoted to the post of Executive Vice-President.

At the same time, **George K. Licht** was advanced to the position of Vice-President in Charge of Production at the company's two plants in Newark, N. J. He joined Titeflex in 1935 and was appointed Works Manager in 1948.

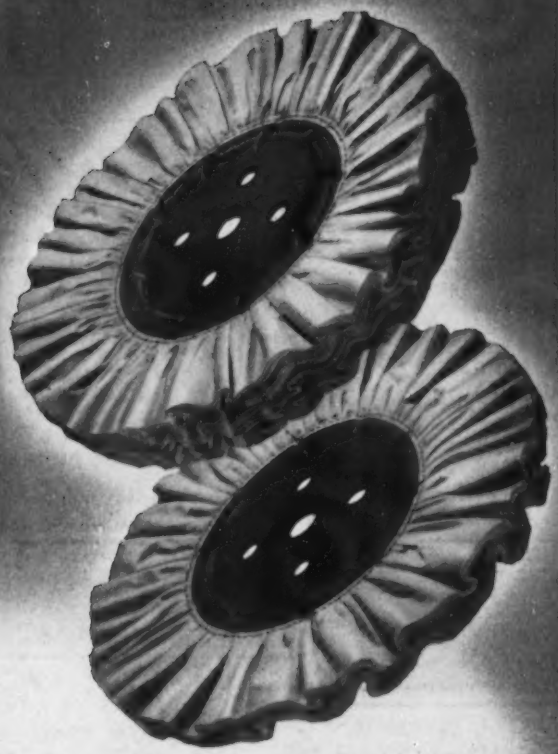
John J. Phillips, the new Vice-President in Charge of Sales and Engineering, joined Titeflex in 1940 and became Chief Engineer in 1949.

S. J. "Pat" Stowell has been appointed Merchandise Manager of the Kold-Hold Manufacturing Company. He will be re-

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 416.

Unsurpassed!

Ventilated
NON-FRAY
BUFFS



by

CODMAN

For Over 55 Years the Greatest Name in Buffs

Buffing and Polishing Wheels of Every Type for Every Operation

F.L.&J.C. CODMAN COMPANY

ROCKLAND • MASSACHUSETTS

THE CODMAN NON-FRAY VENTILATED BUFFS ARE MADE UNDER PATENT NUMBERS 2,027,863; 2,094,650; 1,573,981; RE. 19,894; 2,140,208. OTHER PATENTS PENDING

BRANCH OFFICES: PHILADELPHIA · DETROIT · LOS ANGELES · INDIANAPOLIS · GRAND RAPIDS

treat TOXIC CHROMIUM WASTES *by* REDUCTION

Chromium wastes, because of their toxicity and high color, are a problem for industry and an annoying source of stream polution.

Reduction of toxic hexavalent chromium wastes to the trivalent form with sulphur dioxide, and subsequent precipitation with alkali, has become widely accepted in the plating industry. Wallace & Tiernan offers not only the equipment for feeding sulphur dioxide but also the experience of many installations to successfully carry out the reduction process.

CYANIDE WASTES

Wallace & Tiernan's service to the metal finishing industry also includes experience and equipment for effective destruction of cyanide wastes by alkaline chlorination. Automatic control equipment assures complete cyanide destruction with minimum chemical costs.

Write today for additional information on Wallace & Tiernan equipment for the reduction of toxic chromium wastes with sulphur dioxide and the oxidation of cyanide wastes by alkaline chlorination.

W & T Sulphur Dioxide Feeder

WALLACE & TIERNAN
COMPANY, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES

S-78

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 418.

Personals

sponsible for correlating sales of all of the company's products.

Prior to his recent return from duty with the U. S. Navy, Stowell was District Sales Manager for the Lonergan Manufacturing Company and Refrigeration Corporation of America. He has had wide and varied experience in both the refrigeration and heating fields.

Charles E. Glennon has been appointed sales engineer for the Platecoil Division of the Kold-Hold Manufacturing Company. Glennon's professional career started with postgraduate work in metallurgy, engineering and journalism. Following this he served six years as assistant to the Chief Inspector and Engineer of Tests at the Gary Works of Carnegie Illinois Steel Corporation.

James D. Wilkinson has been named Manager of the Market Research Division by Beckman Instruments, Inc.

Wilkinson

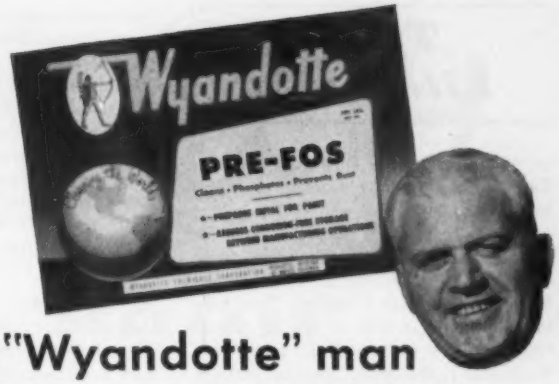
Formerly Manager of Commercial Research at Soule Steel Corporation, San Francisco and regional research manager for Kaiser Aluminum and Chemical Sales Corporation, Chicago and Oakland, Wilkinson brings a highly specialized background to his new position. He received the first degree ever given in Public Relations at the University of California in 1949. His academic training includes electronics at the University of Houston, industrial relations at the University of California and engineering at Los Angeles City College.

CHEMIST WANTED

Chemist wanted by leading New England Manufacturer and Distributor of plating chemicals, supplies and equipment.

Work principally development and research on metal cleaners, buffing compounds, and finishing processes. Opportunity for customer contact and service work with eventual sales position a possibility. Reply in writing stating experience, training, and salary requirment. *Reply to:*

P-453-E PLATING
445 Broad St., Newark 2, N. J.



WYANDOTTE CHEMICALS

Let the "Wyandotte" man Give YOU the sensational

PRE-FOS PERFORMANCE STORY

SPEEDED PHOSPHATING 50%!

"Wyandotte PRE-FOS cleans better; deposits a fine-grained phosphate coating which helps hold paint and prevent rust. PRE-FOS speeds up our phosphating 50%; is cheaper and lasts longer." *Detroit, Michigan**

SUCCEEDED WHERE OTHER PHOSPHATING CLEANERS HAD FAILED!

"In our operation, we had previously tried most of the other available phosphating cleaners with only partial success. But we have found that PRE-FOS gives us superb paint adhesion, excellent cleaning and rust protection. Wyandotte PRE-FOS has proved completely successful." *Chicago, Ill.**

CUT COSTS UP TO 75%!

"With Wyandotte PRE-FOS we get better cleaning and paint adherence, elimination of hard-water scaling. Our cost formerly was four times as great as it is now with PRE-FOS!" *Canton, Ohio**

ELIMINATED ONE PRODUCTION STAGE!

"PRE-FOS enabled us to completely eliminate one stage in our operation. We cut production time, saved valuable shop space, obtained better cleaning and paint preparation." *Detroit, Michigan**

Other reports on Pre-Fos:

"We now run one to two weeks longer before dumping!"

"Humidity cabinet resistance improved 80%!"

"Best cleaning our washer has ever produced!"

Call in your Wyandotte service man today. Ask him to show you how amazing PRE-FOS can help you. Send the coupon for more PRE-FOS information. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Angeles 12, California.* *Names on request

CLEANING THE WORLD

Largest manufacturers of specialized cleaning products for business and industry.

Wyandotte CHEMICALS

Helpful service representatives in 138 cities in the United States and Canada

Wyandotte Chemicals Corporation
Wyandotte, Michigan

Please send data on PRE-FOS:

Name_____

Firm_____

Address_____

City_____ Zone____ State_____

Trade Literature

L—400. New Buff Bulletin—Hanson-Van Winkle-Munning Company, Matawan, N. J., announces a new 12-page 8½ x 11 inch bulletin on disc-type buffs for cutting and coloring. Covering three basic types of buffs, the bulletin contains 20 illustrations and 4 tables. Text tells when to use and how to specify pieced buffs, full disc buffs and the new Acme Ventilated Ruff-L-Buff. Also covered are Acme Ventilated Contact Wheel Sections used with abrasive belts. The first section of the bulletin is devoted to technical information on heavy duty Ruff-L-Buffs. Lead-center and other jeweler buffs are tabularized according to diameter, ply, rows sewing, and thickness. Pieced buffs are classified as to grades, and specification data include the approximate weight per section for eight different buff diameters and seven kinds of cloth. Concluding the booklet is a technical section covering seven types of buff sewing. For copies of the bulletin—Specify B-100P—write to H-VW-M Company, Matawan, N. J., or use Reader Service Card.

L—401. Nickel Immersion Coatings—A reprint of 4 pages in which are reviewed the relative advantages and limitations of two non-electrolytic nickel-coating processes, the displacement and the "electroless". They are shown to be not competitive with each other or with electroplating. The operation of the processes, the nature of the deposits, physical properties, protective value, efficiency and potential applications are discussed. The displacement method is limited to coating under 50 millionths inch on iron or steel bases and is visualized as an inexpensive way of making a superior base for other coatings. The "electroless" process is suggested where such advantages as uniform coatings of several mils to a variety of bases regardless of shape, including intricate interior surfaces, will justify the cost. No heavy capital investment is needed. Under certain conditions the deposit is non-magnetic, and where high hardness is desirable it may be heat treated. For your copy of this reprint write to the International Nickel Company, New York 5, N. Y., or use Reader Service Card.

L—402. Cleaning Compounds Booklet—The cleaning problems that confront the electroplating industry and suggested methods of treatment and solution of those problems are thoroughly and concisely covered in a new booklet issued by Magnuson Products Corporation. The new booklet, handsome and easy to read with a comprehensive cross-index, delves into job definitions, job requirements and the considerations necessary in choosing the proper cleaning materials for the job at hand. In addition, safety notes, operating practices and conversion factors and formulas enhance the value to all engaged in electroplating. For your copy of booklet PM-1, which is a handy index-card-file size, write Magnuson Products Corporation, 50 Court St., Brooklyn 1, N. Y., or use Reader Service Card.

L—403. Promat Metal Finishing Products Bulletin—A four-page bulletin issued by Promat Division, Poor & Company, 851 S. Market St., Waukegan, Ill., provides a condensed description of the company's zinc, cadmium, copper and white-alloy plating baths. Also described are secondary chromate treatments to render magnesium, aluminum, zinc and cadmium surfaces more corrosion resistant and/or paintable. Addition agents for metal cleaning baths are also listed. For your copy of bulletin 5-52P write to the manufacturer, or use Reader Service Card.

L—404. Calrod Heating Catalog—A 1953 edition of General Electric's catalog on Calrod electric heaters and heating devices has been announced as available from the Company, Schenectady 5, N. Y. Designated as GEC-1005D, the 60-page, two-color information and buying guide describes the equipments in terms of application, special features, installation, and pricing. Indexed by process and application, the catalog also contains methods of determining power requirements and heat losses by applications. For your copy use Reader Service Card.

All chemists wear white coats!

Unlikely and unimportant but even if they look alike there's an important difference between them. KLEM chemists have dealt with almost every conceivable problem in their field. Their extensive experience enables them to more readily comprehend plant situations than ordinary chemists. The KLEM laboratory, equipped with the finest technological equipment for duplicating exact plant conditions and procedures, enables them to determine the correct answer to tough problems.

Let us help eliminate your bottlenecks, assist you as we have others in establishing profitable production schedules.

Representatives in most industrial areas.

3 OF 20 STANDARD KLEM PRODUCTS

KLEM STRIPPER No. 73—Heavy duty hot stripper for paint and enamels, rinses easily, eliminates hand scrubbing.

WATER WASH COMPOUND No. 203—Stops corrosion, keeps lines clean, prevents adhesion of paint to water curtain. Excellent for recovery.

RUST-SOL No. 124—Concentrated phosphoric acid surface conditioner. Removes oil and rust. Provides slight etch to promote adhesion of paint. Meets USA 3-213, TAC-ES431 and MIL-C-10578.

KLEM PRODUCT of the MONTH

MINIT KOTE

Cleans, neutralizes, phosphatizes in 60 seconds. Frees metal surfaces from all traces of oil and dirt. Deposits light, uniform, phosphate coating for better adhesion of paint to ferrous metals and aluminum. Write for details.

KLEM Chemicals Inc.

14601 LAWSON . . . DEARBORN, MICHIGAN

RESEARCH

WHY INVEST IN RESEARCH

THE word "invest" is used because that is exactly what a sustaining membership in the American Electroplaters' Society means. It is an investment, not a contribution. When you become a Sustaining Member, you are investing your money in research which, because of its basic and complex nature, would never be conducted except by group effort. This research means progress.

Whether your plating facilities are large or small, you can't afford not to support this program. Whether you are a large manufacturing company with extensive metal finishing operations or whether you are a small job shop, you have a definite stake in the future of electroplating. While the large companies usually have their own laboratories to study their own particular problems, they cannot afford to undertake research of such a broad nature as is conducted in A.E.S. Research. At the same time, savings which they can realize from such projects as Project No. 5, "The Effect of Impurities and Purification on Electroplating Solutions" can be tremendous. Also, the disposal of plating room wastes is much more acute with the large companies than with the smaller ones, and this problem is being studied in one of the Research Program's most active projects, Project No. 10.

For the smaller plating facilities, the wisdom of participating in this research program is equally obvious. The small shops many times cannot afford to hire a chemist or maintain a laboratory, or if they do have a laboratory it is usually very small and limited in its operations. These shops, by supporting A.E.S. Research, receive all of the progress reports and all other data on the research projects the same as the largest manufacturer. Of fundamental importance to the small shops are A.E.S. Project No. 12, "The Cleaning and Preparation of Metals for Electroplating" and Project No. 15, "Accelerated Corrosion Tests for the Performance of Plated Coatings." This latter project seeks to establish the cause of wide variations in salt spray and weathering tests.

The A.E.S. Research Program needs, and deserves, your support NOW. As in any organization, your society is only as strong as you, the members make it. Shortages and substitutes and defense efforts coupled with civilian demands for high quality, subject the industry once more to terrific tests. It must rise to meet this challenge, as it has met others in the past. One of the most effective means for doing the job is the continuation and expansion of the A.E.S. Research Program. A Sustaining Membership costs $100.00 per year. Checks should be made payable to "A.E.S. Research" and mailed to your local Research Finance Committee Chairman or direct to the American Electroplaters' Society, 445 Broad Street, Newark 2, N. J.

• • •

INVEST NOW!!!

"YOUR BEST BET'S THE A.E.S. RESEARCH PROGRAM"

Trade Literature

L—405. Easy Plater—Yorktowne Special Products, 25P E. Broadway, Red Lion, Pa., announces the introduction of an industrial Easyplater line, a modified model of their hobby electroplating outfit. With this model the Easyplater process is now available for small shops or for the large plants that have little plating. The present available finishes are bright nickel, cadmium, copper and zinc. An illustrated bulletin is available. For your copy use Reader Service Card.

L—406. Pressure Blast Bulletin—The Cro-Plate Company, Inc., 745 Windsor St., Hartford 5, Conn., announces the availability of a special combination packet of technical and promotional literature designed to show 29 specific ways in which the costs of deburring, descaling, microinch surfacing and general metal finishing operations may be reduced through the use of Pressure Blast high velocity wet-blasting equipment and appropriately compounded Pressure Blast abrasives. For your copy of the packet use Reader Service Card.

L—407. Portable Vacuum Testing Units—Compactly mounted on a fabricated steel base so that the entire unit can be transported by truck, fork truck or crane to any point where there is a need for a vacuum system, new vacuum pump trucks have been announced by the F. J. Stokes Machine Company, Philadelphia, Pa. They can be used as emergency equipment for the vacuum processing of a product or production materials or to test pipelines, vacuum and storage chambers, pumps and other equipment that must be vacuum-tight.

These pump wagons are available in two models. For further information on these units use Reader Service Card.

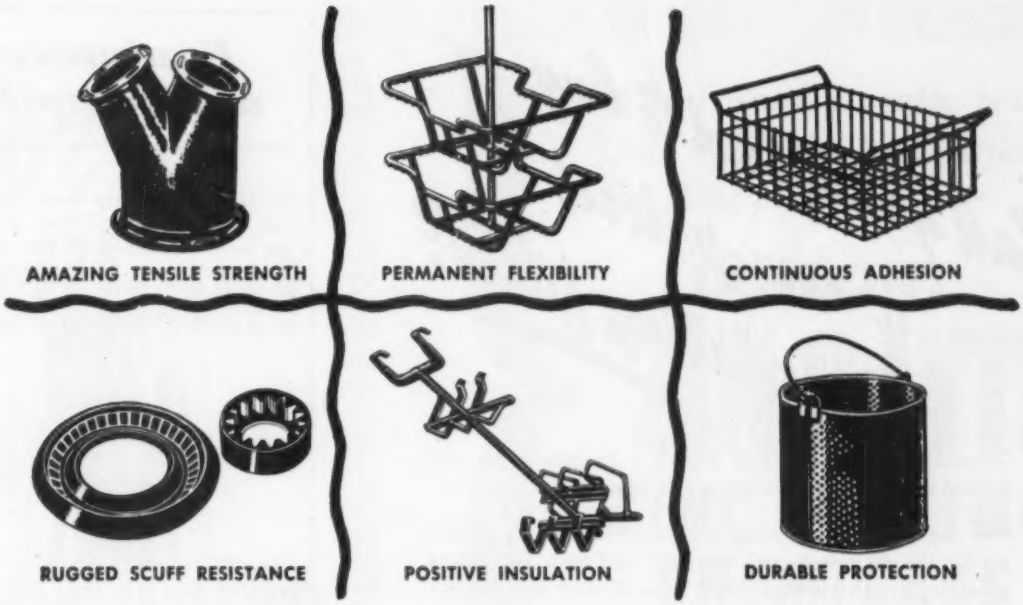
L—408. Rotoblast Literature—Pangborn Corporation of Hagerstown, Md., announces the availability of a 12-page, two-color Bulletin No. 223P on the new Blastmaster Rotoblast. Showing the new "GN" Barrel, the bulletin illustrates the eight exclusive construction features that make this new machine especially attractive to the foundry and metal finishing fields. One of its many features shown is a steel mesh door—the first really abrasive-tight door ever placed on the market. Other illustrated features of this high-production-rate blast machine include: heavy rubber curtain; work conveyor drive with automatic torque throw-out arm protection; anti-friction roller bearings; non-pinch work conveyor; heavy-duty drum ends; and convenient conveyor take-up. Bulletin No. 223P may be obtained by writing directly to Pangborn Corporation, Hagerstown, Md., or through use of Reader Service Card.

L—409. Magnavator Catalog—Prab Conveyors, Inc., 19875 Mack Ave., Detroit 36, Mich., announce the release of Catalog No. P-300 which describes their new automatic small parts elevator. Typical uses of the Magnavator are listed as follows: feeding elevated hoppers, elevating and metering parts to conveyors, etc. For your copy of this catalog use Reader Service Card.

L—410. Blast Cleaning Bulletin—Descaling hot-rolled steel strip at high speeds and low cost by means of airless blasting is the subject of bulletin 894, published by American Wheelabrator & Equipment Corporation, 1180 S. Byrkit St., Mishawaka, Ind. The bulletin describes how airless blasting eliminates scale breaking, permits descaling at production line speeds of from 190 to more than 400 feet per minute reduces the use of pickling acid, reduces manpower and space requirements, and saves metal (since airless blasting removes scale only). For your copy of this 4-page bulletin use Reader Service Card.

L—411. High Temperature Lubrication Bulletin—How "dag" colloidal graphite has been used successfully to lubricate kiln cars at 450° F is described in a new, illustrated bulletin issued by Acheson Colloids Company. Under these operating conditions commonly used oils and greases are ineffective. Copies of "'dag' Colloidal Graphite as a High-Temperature Lubricant" may be obtained by writing to Acheson Colloids Company, Division of Acheson Industries, Inc., Port Huron, Mich., or through use of Reader Service Card.

Question!
How to Solve Your Thickness Problems?
Answer!
With the New KOCOUR Electronic Thickness Tester!
DETERMINES THE THICKNESS OF METALLIC COATINGS
BETTER! . . . FASTER! . . . EASIER! . . . CHEAPER!
The new KOCOUR ELECTRONIC THICKNESS TESTER is the answer to your thickness problems . . . QUICKLY and almost AUTOMATICALLY . . . this highly accurate instrument can determine the thickness of all the commonly plated metals on various base metals . . . thus putting an end to costly rejects and reworking.
KOCOUR'S NEW ELECTRONIC THICKNESS TESTER HAS THESE OUTSTANDING FEATURES:
Set is self-contained.
90-95% accurate depending upon type and thickness of the plate.
Average test requires only about 1 minute.
Minimum thickness determined is 200,000's of an inch (5,000,000 for chromium).
Maximum thickness determined is indefinite.
Operates virtually automatically.
Reads directly . . . no calculations necessary.
Relatively insensitive to surface roughness.
Compactly housed in portable metal cabinet, 17½x18½10".
Operates from 105-125 volt, 60 cycle, A.C. electric outlet.
Write today for full information . . . no cost or obligation.
KOCOUR Company
DEPT. PA
4801 SOUTH ST. LOUIS AVENUE
CHICAGO 32, ILLINOIS
Specify KOCOUR TEST SETS from Your Supplier!
Pioneers and Specialists in Testing Equipment Since 1924
P.S. Whether your set-up calls for small or large volume work . . . there's a specialized KOCOUR SET for your requirements . . . developed to do a faster, better, more economical job.



When...

THEY'RE MICCROSOL COATED

They Meet the Highest Industrial Standards

MICCROSOL E-1003 Heat-Cured Rack Coating is a 100% solids, non-evaporating material that produces a smooth, tough, leather-like coating which will often outlast the rack. Exceptional adhesion is achieved through the use of our primers.

In addition to the outstanding characteristics listed above, tests for abrasion and resistance to all commonly used plating solutions, acids, and caustics show superior performance in comparison to similar products. MICCROSOL E-1003 has proven to excell as a coating for materials-handling equipment, baskets, hangers, and a wide variety of plating equipment parts.

MICCROSOL E-1003 has an exceptionally high gloss, allowing free drainage, and no solution carry-over.

We will be pleased to help you with your coating problems. Send us full particulars.

MICCRO Products

MICHIGAN CHROME
and Chemical Company

6351 East Jefferson Avenue • Detroit 7, Michigan

SPARKLER FILTERS · SPARKLER FILTERS

Can you afford to buy a low-priced plating filter?

In many instances the first cost of a Sparkler filter will exceed that of some other types of plating filters.

But the savings in operating cost soon will more than make up for the difference, and you will find your Sparkler a good investment both on the basis of cost and quality of performance.

For example:

★ Pre-coating Sparkler horizontal filter plates requires only about one-third the amount of filter aid used by some other filters.

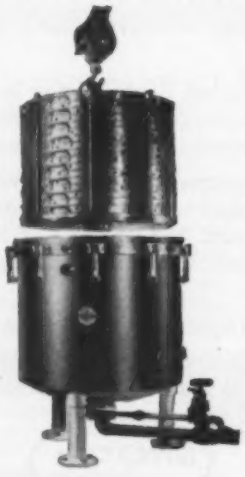
★ Only a thin pre-coat is necessary, and you can get brilliant sharp clarity right from the start.

★ Intermittent operation of the filter will not break up the cake on horizontal plates. No renewal of pre-coating is necessary after a period of inactivity.

★ A wide range of fineness of filter media is possible with Sparkler filters.

★ Sparkler filters are ideal for alloy plating solutions. Non-metallic filter plates and rubber lined tanks are available when required.

These are a few of the many operating advantages that make Sparkler plating filters the most economical in labor and material cost and most satisfactory from a standpoint of filtering quality.



An extra set of plates that can be changed in a matter of minutes cuts "down-time" to a minimum.

Sparkler representatives in all principal cities are available for personal service on your filtering problems.

SPARKLER MANUFACTURING CO.
Mundelein, Illinois

Sparkler International Ltd.
Prinsengracht 876, Amsterdam, Holland

Kamitter & Co.
35 Chittaranjan Ave., Calcutta 12, India

Sparkler Western Hemisphere Corp.
Mundelein, Ill., U.S.A.

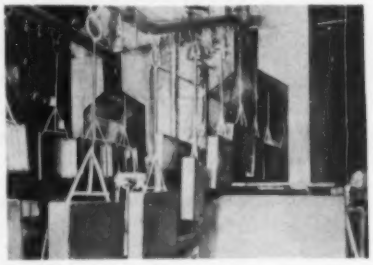
SPARKLER FILTERS · SPARKLER FILTERS

Equipment and Supplies

E—412. Safety Grip Work Gloves—A new type "safety grip" finish is now being used on the Edmont line of coated fabric work gloves. Extending from the

middle of the palm to the ends of the fingers, the improved finish offers three important advantages—better wet grip, longer wear, won't chip, crack or peel. The new finish is made of a material which cures into and becomes a part of the base (reinforced neoprene) coating. Premium quality Redmont gloves are available in five styles ranging from a fully coated knit-wrist to an elbow-length gauntlet—all with the improved "safety grip" finish. For additional information write Edmont Manufacturing Company, 1250 Walnut St., Coshocton, Ohio or use Reader Service Card.

E—413. Continuous Stripping Now Practical—The stripping of paint from conveyor hooks, hangers and other conveyor line handling equipment, as well as



paint rejects, can now be done rapidly by a new method. New stripping chemicals make production conveyor line operations a fact. Announcement of this new development which meets rigid specifications is made by Klem Chemicals, Inc., 14401 Lanson Ave., Dearborn, Mich. Extensive tests of the procedure indicate a savings up to 90 per cent in time. The new high speed, one-step stripper can also be applied by production spray methods, if desired. For additional information use Reader Service Card.

For Brilliant Zinc Deposits Without Bright Dipping!

If you want a really brilliant zinc plate, adopt this Du Pont process using:

DU PONT "ZIN-O-LYTE" ZINC PLATING CHEMICALS

CHECK THESE OUTSTANDING FEATURES

1. **YIELDS BRILLIANT** blue-white, rust-resistant deposits direct from the bath without *bright dipping!*
2. **GOOD OPERATING EFFICIENCY.**
3. **BATHS EASILY** made up from prepared salts.
4. **SUITABLE** for all types of zinc plating, *particularly barrel plating.*
5. **SATISFACTORY** for use with almost all types of ferrous metals.

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Electrochemicals Department, Wilmington 98, Delaware

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☐ Zinc Plating ☐ Tin Plating
☐ Copper Plating ☐ Cadmium Plating

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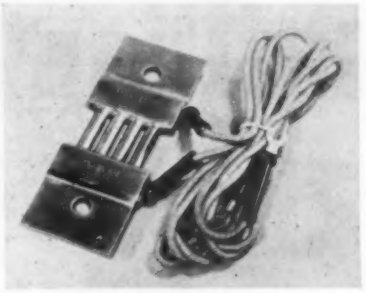
*Firm*_____
*Street & No.*_____
*City*_____ *State*_____

Equipment and Supplies

E—414. Neoprene Painting System—The Pennsylvania Salt Manufacturing Company, after three years of testing under the most severe corrosion conditions in its own plants, has introduced a new system of anti-corrosion coating using specially formulated neoprene coatings. The new system has resulted in savings up to 50 per cent per square foot in the maintenance painting and coating costs in the company plants. The special formulations are NeoCoat and NeoPrime A (for all surfaces except concrete) and NeoPrime B (for concrete surfaces). In a number of cases, it was reported, the overall initial cost of using the new system appeared to be higher than other methods, but measured against maintenance painting costs over several years, the new system was about half that of other systems. Pennsalt also developed a method of planned inspection and repair to further reduce costs. For additional information use Reader Service Card.

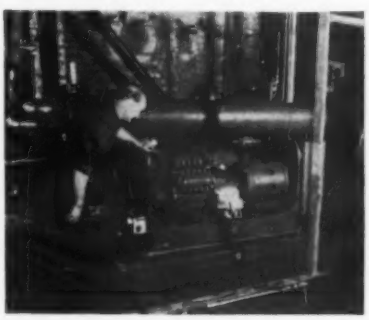
E—415. Decorative Plating Processes Requiring No Nickel—Promat Division, Poor & Company, 851 S. Market St., Waukegan, Ill., has developed two decorative plating processes for use on parts commonly having a copper-nickel-chrome finish. No nickel is employed in the processes designated as Probrite CR-723. Both finishes can be deposited over steel or copper and can be chrome plated readily. A new Promat Sealer for use over the chrome plating prolongs life of the finish. Brilliance of the finishes is reported comparable to copper-nickel-chrome. Technical data is available. Use Reader Service Card.

E—416. Direct Current Ammeter Shunts—Rapid Electric Company, 2881 Middletown Rd., Bronx 61, New York, has announced a complete line of direct



current ammeter shunts designed for use with 50 millivolt meter instruments. Sizes range from 150 to 10,000 amperes. These units are calibrated to within ½ to 1 per cent accuracy and are complete with 10 foot calibrated leads. This new development has greatly reduced the cost of high quality shunts and has made immediate delivery possible. For additional data use Reader Service Card.

E—417. Automatic Refrigeration System for Bath Cooling—Great Lakes Plating Division, Great Lakes Industries, Chicago, has solved its bath cooling problem, switched to high current density operations, increased production and lowered costs with one change. The change:



an automatic refrigeration system for bath cooling designed by Belke Manufacturing Company, Chicago. This new bath cooling method has resulted in enough production increases to pay for itself within just a few months, according to Belke engineers, and the system promises to be as effective with virtually any zinc, cadmium and white brass plating bath.

It is said to be adaptable with some modifications to bath cooling in anodizing, electrolytic pickling, and many other similar processes. Wherever bath temperatures must be maintained between

Satisfactory metal cleaning, *particularly* before plating or vitreous enameling, demands *complete* removal of chips and all other solid dirt, as well as grease or oil.

YOU'VE GOT TO HAVE SCRUBBING ACTION as well as solvent action. That's why the degreasing method, very satisfactory on oil and grease, falls down when chips and solid dirt have to be removed.

GET IT WITH THE RIGHT MACHINE

Magnus Aja-Dip Cleaning Machines supply a unique mechanical scrubbing and shearing action for removal of solid dirt. In these machines the work *itself* moves up and down in the cleaning solution many times a minute. Your Magnus cleaner works even more satisfactorily in these machines because of far better contact with the dirt. In addition you get positive and vigorous *mechanical* action on *every* surface of the work... even in areas not reached by ordinary cleaning solutions or methods of agitation.

A Size to Meet Your Needs

The Magnus Line of Aja-Dip Cleaning Machines gives you batch cleaning that's so simple and speedy that it is practically a one-man continuous job. Available in capacities from 75 to 2200 lbs. per load.

PUT YOUR PROBLEM UP TO US. *We can help you save man-power and cleaning dollars. We're ready to show you what we can do... either in your own plant or in the Magnus Pilot Laboratory.*

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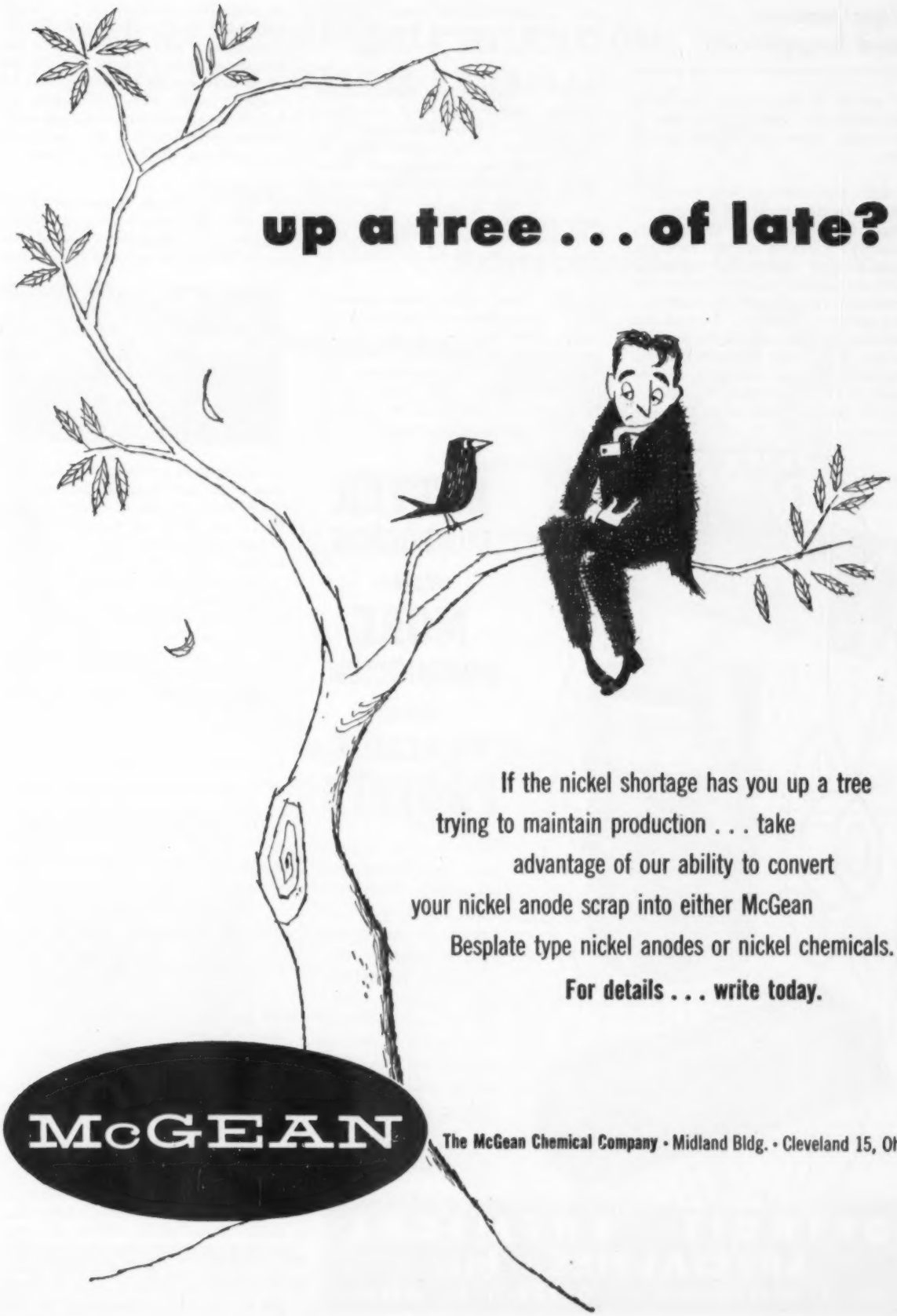

up a tree . . . of late?

If the nickel shortage has you up a tree trying to maintain production . . . take advantage of our ability to convert your nickel anode scrap into either McGean Besplate type nickel anodes or nickel chemicals.

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Equipment and Supplies

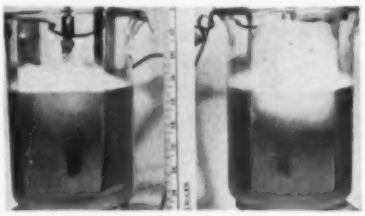
45° and 90° F, this method may be applied efficiently. For additional data on the cooling system use Reader Service Card.

E—418. Soft Asbestos-Neoprene Gasket—A new gasket material has been developed from asbestos and the Du Pont Company's synthetic rubber, neoprene. Asbestoprene is made by Victor Manufacturing and Gasket Company, Chicago, and is unusual in that it combines compressibility with heat resistance. In these two properties, the new material fills a gap in the line of gasketing materials between compressed asbestos sheet and cork or rubber. It has good dimensional stability, does not cause corrosion of light metals and is resistant to oils, water, gasoline, and antifreeze solutions. For further information use Reader Service Card.

E—419. Variable Speed Polishing and Buffing Lathe—Hammond Machinery Builders, Inc., Kalamazoo, Mich., announce a new 10 horsepower model 10 VRO variable speed polishing and buffing lathe. This new lathe has a speed range of 1500 to 3000 rpm. Speed is changed instantly while the lathe is running by turning the dial control. For further information use Reader Service Card.

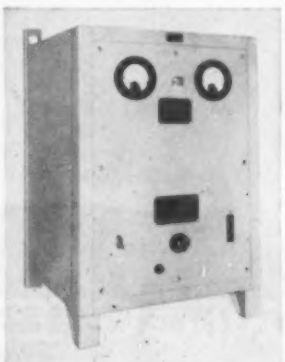
E—420. New Active, Non-Corrosive Rosin Core Solder—A new rosin core solder, active yet non-corrosive, has recently been developed by Federated Metals Division, American Smelting and Refining Company, New York, N. Y. Known as RTS 200, it has been proved in production operations to have many advantages over ordinary rosin solders. Tests show 30 per cent greater spread and four times faster fluxing. Despite this exceptional activity, there is no harmful corrosion residue when tested under the high humidity conditions of military specification MIL-S-6872. For additional information use Reader Service Card.

E—421. Low Foam Formation Cleaners—New formulas recently perfected and field-tested by Wyandotte Chemicals Research Division reduce foam formation up



to 50 per cent in electro-cleaning solutions. The new formulas now apply to the following Wyandotte products, F.S., No. 90 and B.N. In the photo shown, Wyandotte F.S., left, and a competitive product, right, were given an identical one-hour electrolytic treatment. In addition to reducing foam by better than 50 per cent the new Wyandotte formulations are now less dusty than other products used for metal cleaning. Wyandotte claims that use of these newly formulated products minimizes workers' complaints normally caused by coughing, sneezing and skin irritations, and lessens the likelihood of explosions from foam trapped hydrogen gas. For additional information use Reader Service Card.

E—422. 110 Volt DC Power Supply—An automatic regulated d-c Thyratron power supply has been developed by the



Richardson-Allen Corporation. The d-c output is 110 volts, ±5 volts at 5 amperes. The a-c input is 100 to 130 volts, single phase at 60 cycles. The power supply includes d-c instrumentation and a filter circuit to permit 1 per cent ripple and is housed in a cabinet 16 x 16 x 25

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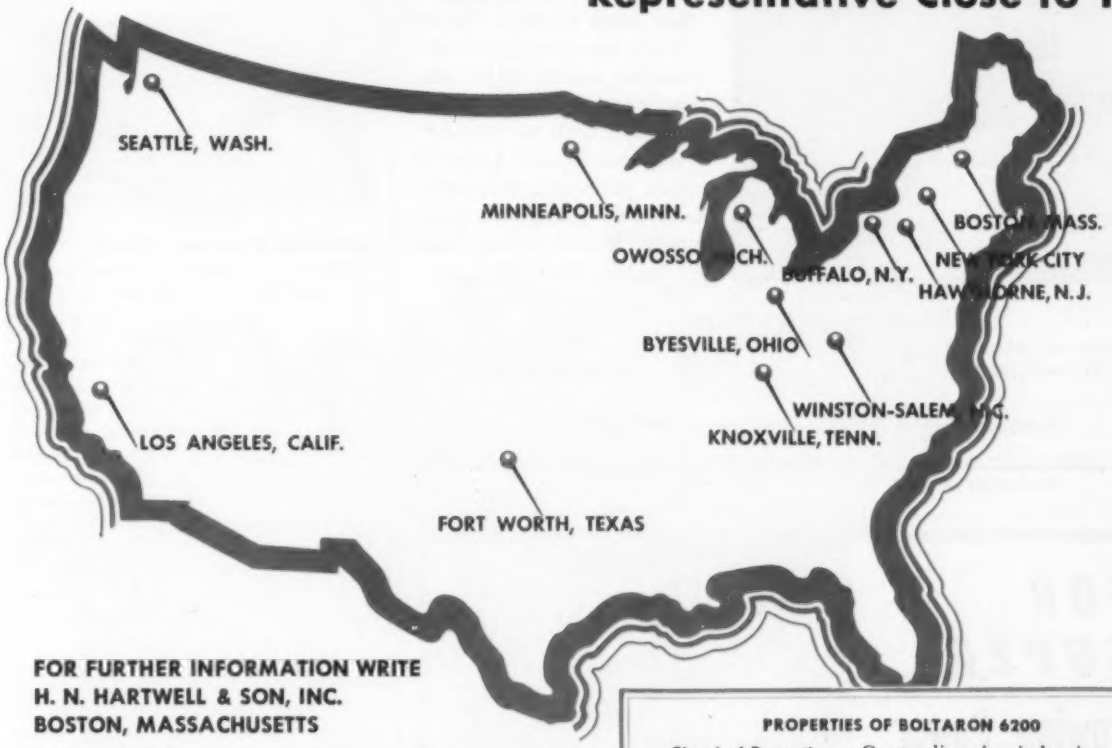
YOU'LL GET IMMEDIATE ATTENTION TO YOUR CORROSION PROBLEMS

from the Boltaron 6200 Representative Close to You



FOR FURTHER INFORMATION WRITE
H. N. HARTWELL & SON, INC.
BOSTON, MASSACHUSETTS

Boltaron 6200 is the outstanding corrosion-resistant material on the market. It retains the properties of unmodified, rigid, unplasticized Polyvinyl-Chloride.

Our fabricators have been thoroughly trained to make the most efficient use of Boltaron 6200. They are fully qualified to design and fabricate economical corrosion-resistant Boltaron 6200 systems.

Available Forms of Boltaron 6200

Sheets — Size 30″ x 60″ (approximately); Thickness 1/32″ to 1″. *Rod Stock* — (10′ lengths) ¼″ to 2″. *Pipe* — (10′ and 20′ lengths) ¼″ to 3″. *Fittings* — (Standard, threaded I.P.S.) ¼″ to 2″.

PARTIAL LIST OF USES

Electroplating	Food Processing
Anodizing	Dairy Products Processing
Dyeing & Bleaching	Textile Processing
Tanning	Photographic Processing
Brewing	Industrial Plumbing

H. N. HARTWELL & SON, INC.
Industrial Plastics Division • Park Square Building, Boston 16, Mass.

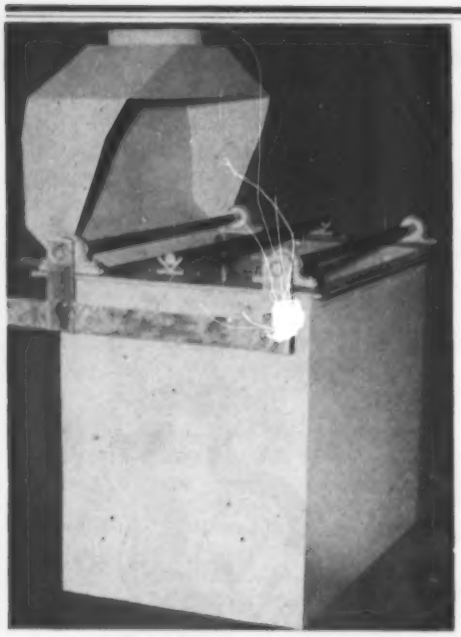
PROPERTIES OF BOLTARON 6200

Chemical Properties — Outstanding chemical resistance to organic and inorganic acids, alkalies, alcohol and foodstuffs. Laboratory tests are continuously carried on. Specific information available on request.

Mechanical Properties — Boltaron 6200 is non-toxic, may be drawn, formed, molded and machined . . . and can be welded by the hot air method.

Physical Properties:	ASTM Method	
Specific Gravity	D792-48T	1.4
Tensile Strength — psi	D638-49T	8500
Modulus of Elasticity in Tension — psi	D638-49T	4.5×10^5
Flexural Strength — psi	D671-49T	16,000
Compressive Strength — psi	D695-49T	10,000
Hardness (Rockwell)	D785-48T	M-60
Heat Distortion °F — 66 psi (Maximum Useful Temperature)	D648-45T	165°F
Coefficient of Linear Expansion inch/inch/1°C	D694-44	6.7×10^{-5}
Thermal Conductivity Cal/sec/cm²/°C/cm	C-177	4×10^{-4}
Specific Heat Cal/gm/°C	Calorific Method	.24
Dielectric Constant @ 1 megacycle	D150-47T	3
Water Absorption % 24 hrs. @ 25°C	D570-42	.05
Flammability	D568-48	Self Ext.

Boltaron 6200 is manufactured in the United States



Stortswelded Fabrication is the complete answer

STORTS plating tank units, complete with casing, coils and copper work yield outstanding satisfaction because they bring together highest quality materials and workmanship values under one-source responsibility and are delivered with an unconditional guarantee. Large or small, plain or lined, single tanks or complete tank cycles, Storts builds them all for long life utility.

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- HERRINGBONE
- FLAT
- SPECIAL

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HEIL PROCESS EQUIPMENT CORPORATION

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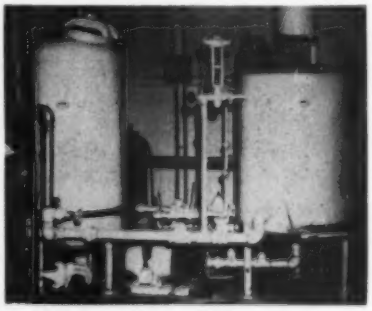
Equipment and Supplies

inches. For further information write Richardson-Allen Corporation, 116-15 Fifteenth Ave., College Point, L. I., N. Y., or use Reader Service Card.

E—423. Wet-Proof Flexible Metal Conduit—"Sealite" flexible electrical conduit type UA is the first of its kind to gain Underwriters' Laboratories approval

for use in wet locations. This liquid-tight flexible metal conduit is manufactured by The American Brass Company of Waterbury, Conn. The tough, extruded synthetic covering over Sealtite Type UA's flexible metal core protects wiring against moisture, oil, dirt, chemicals, and corrosive fumes on permanent and temporary installations. The conduit is made of spirally wound, interlocked zinc-plated steel strip with a copper bonding conductor wound spirally in the space between each convolution on the inside of the conduit. Sealite UA is available in long lengths in nominal electrical ID sizes ⅜ to 1¼ inches inclusive. For additional information use Reader Service Card.

E—424. Tank Type Pressure Filter—A new tank-type pressure filter being introduced by the Ogden Filter Company, 4214P Santa Monica Blvd., Los Angeles



29, Calif., for the filtering of electroplating solutions, etc., eliminates all cloths, papers, screens and pads. Yet, the unit insures controlled quality filtration and higher flow rates at much lower operating costs both in filter material and labor. A series of synthetic, rigid porous stone membranes upon which a filter-aid coating is deposited provide a perfect retaining surface for the formation of a con-

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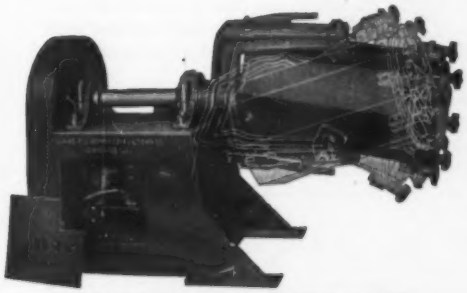
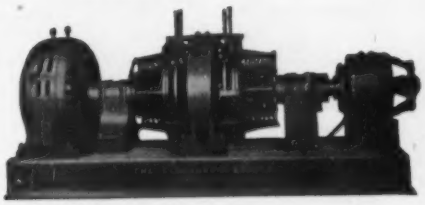
ECONOMY : EFFICIENCY : DEPENDABILITY

LET US SUPPLY YOUR NEEDS FOR YOUR PLATING OR POLISHING DEPARTMENT

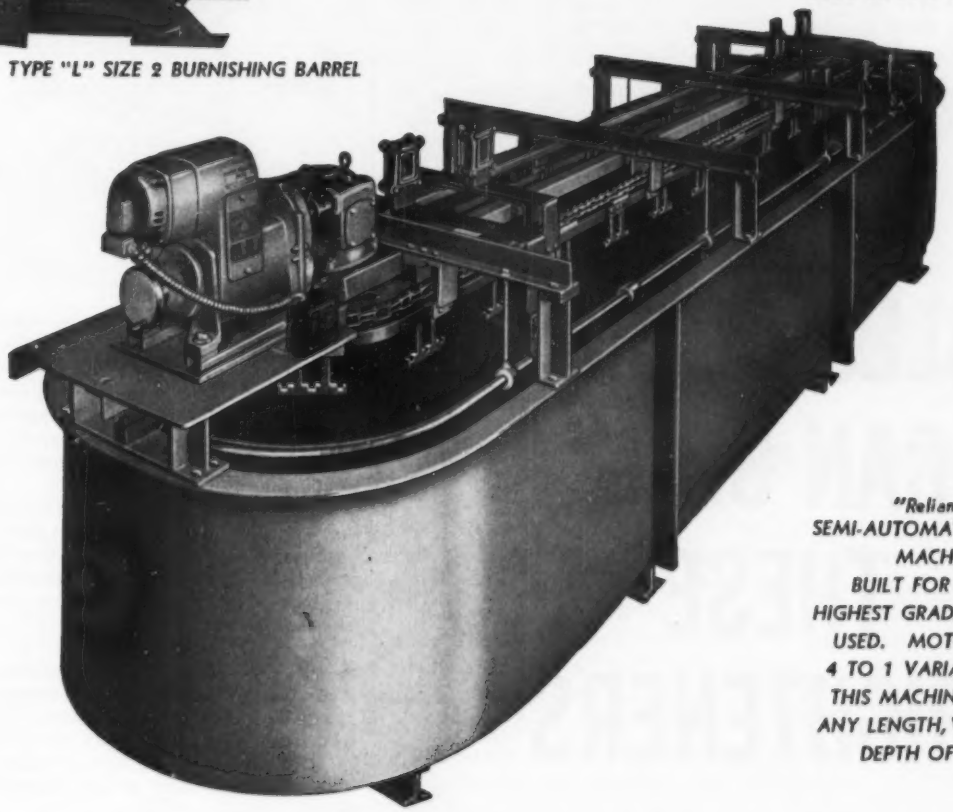
WRITE FOR FURTHER DETAILS



TYPE "L" SIZE 2 BURNISHING BARREL



3000 AMP. 6 VOLT GENERATOR SET



"Reliance" SEMI-AUTOMATIC PLATING MACHINE BUILT FOR SERVICE HIGHEST GRADE MATERIAL USED. MOTOR ½ HP 4 TO 1 VARIABLE SPEED. THIS MACHINE IS BUILT ANY LENGTH, WIDTH AND DEPTH OF TANK.

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Equipment and Supplies

trolled clarity filtration, and allow a fast and thorough backwash. For further information on these filters which are available in all capacities in all metals and alloys as well as plastic or rubber lined to meet specific problems, use Reader Service Card.

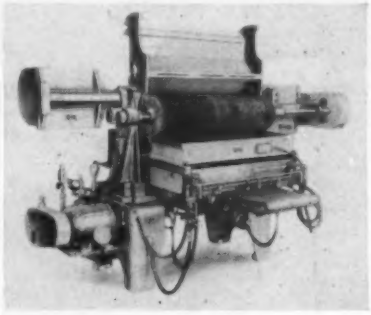
E—425. Ultrasonic Degreaser—A completely new method for fast, efficient degreasing of metal parts has been announced by the Topper Equipment Company, Clark Township 2 (Rahway), N. J. The new cleaning machine uses ultrasonic waves to clean metal parts. It removes oil, grease, chips, dirt, lapping compound and other contaminants from the surface of small precision work pieces at a rate hitherto unobtainable and to a degree of cleanliness that passes the most stringent industrial standards.

A General Electric ultrasonic generator used in conjunction with specially developed Circo Vapor Degreasing equipment technique converts high frequency electrical energy into high frequency mechanical vibration by means of a quartz crystal. This energy is transmitted up through the cleaning tank. The region above the crystal is greatly agitated, accelerating the normal cleaning action. After the ultrasonic cleaning action takes place, the parts are rinsed and quickly dried by the vapor process. The equipment is available in either the continuous production or batch type methods. For additional data use Reader Service Card.

E—426. New Aluminum Oxide Compositions for Finishing Zinc and Aluminum Die-Castings—The Hanson-Van Winkle-Munning Company, Matawan, N. J., announces a new series of aluminum oxide compositions for the coloring operation in the finishing of zinc-base and aluminum die castings. Laboratory tests and supporting field data indicate that these aluminum oxide compositions give castings of these metals the desired luster or color faster than was before possible with compositions of the same grade of fineness.

The aluminum oxide compositions may also be used in steel and stainless steel finishing. For additional information use Reader Service Card.

E—427. Machine for Surface Finishing Hand Tools—The Clair Model 206-A surface finishing machine, a modification of an earlier unit, has been developed specifically for surface finishing wrenches, pliers, screw drivers, ax heads and many other hand tools. A product of Clair Manufacturing Company, 1016 S. Union St., Olean, N. Y., this machine is capable of any surface finishing operation, from rough glaze to highly colored mirror reflecting surface.



It is equipped for either mechanical holding or the use of a magnetic chuck and provides for simple installation of automatic liquid compound applicators. For additional details on the new machine use Reader Service Card.

E—428. Chemical Resistant Joining Compound—The Atlas Mineral Products Company, Mertztown, Pa., announces the availability of a new ductile, chemical resistant sewer joint for joining vitrified clay pipe waste lines in the chemical process industry.

The new patented joint is precast on the job using a new hot-poured plastic composition called JC-60. The molds used on the bell and spigot section are designed so that considerable space remains at the base of the spigot and between these two precast components. When the line is laid, these spaces are filled with a newly developed chemical resistant cold-setting cement called Vitroplast. Thus, the resulting plastic joint is both ductile and resistant to all common solvents, acids and other corrosives expected to be found in chemical wastes. For more information of this new material use Reader Service Card.

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SALES CLAIMS
CAN SELL
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as well as a trial in your own plant!

Write today for a specially priced trial order of the ARP Brighteners for any zinc or cadmium plating solution. Or see your Iridite Representative.

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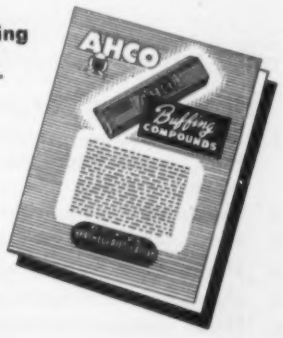
All AHCO Buffing Compounds, including among others tripoli bars, white compounds, and rouges, are formulated of the finest grease binders and abrasives. No matter what surface finish you desire when buffing brass, copper, aluminum alloys, zinc base alloys, lead base alloys, or other non-ferrous alloys, there is one AHCO Compound, or combination of compounds, that's just right . . . for cutting down to an initial smoothness, for cutting down and coloring in a single operation, or for coloring to a high lustre. Like 99% Nucast Nickel Anodes, AHCOLOID Metal Cleaners, and other AHCO Compounds, AHCO Buffing Compounds are the work of experienced chemists. And every order is laboratory controlled for uniform high quality.

For full details about AHCO Buffing Compounds write for Bulletin B-7.



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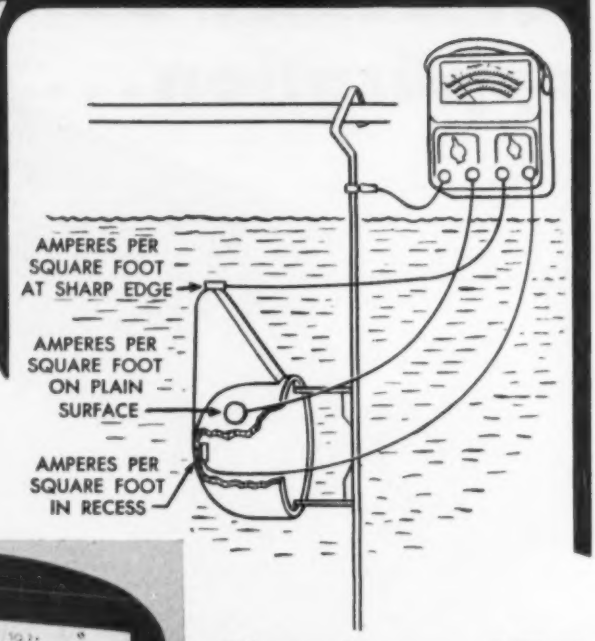
Measure Current Density at the Plating Surface

Now you can know *what goes on at the plating surface* to save time and money a dozen ways! Know where you are plating too fast or too slow — instantly read current density at different points with the article in every conceivable position, with various voltages and with different solutions—check throwing power of the solution instantly without analysis or figuring.

The BELKE-KOTZ Current Density Meter is a veritable watch-dog against plating room waste. Enables you to utilize all your experience and skill in plating to specifications, speeding production, saving time, saving metal, eliminating rejects, etc.



BELKE-KOTZ Current Density Meter

Measures current density in amperes per square foot at desired points on the article under actual plating conditions.

Three test leads permit testing at three selected areas without moving test discs.

Nine scales—0-3, 15, 30, 75, 150, 300, 750, 1500, 3000 amperes per square foot assure sharp readings in any range.

Disc Contacts and Range Selector Switches permit instant reading of current density at any test point on any scale.

Patent Pending

Simple as ABC

With the BELKE-KOTZ Current Density Meter it's easy to know instantly what goes on at the plating surface under any condition.

Just attach a test disc at each of three selected areas on the article.

- Position the article in the tank.
- Connect Meter to cathode. Turn switches and read current density at each of the three test areas.
- You can reposition article, doctor solution, or change voltage and read current density quickly until you get the best combination of position, solution and voltage.
- No figuring. Meter is calibrated in amperes per square foot. You can compare the reading with current density tables for the solution you are using.

Ask your BELKE Service Engineer for particulars or send for literature.

Helps 6 important ways—

1. Enables you to instantly compute plating time for any metal thickness at any point on any article.
2. Shows best position for the article.
3. Shows when auxiliary anodes are needed.
4. Shows when burning bars are needed.
5. Shows when voltage is too high or too low.
6. Shows change in solution throwing power.

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More Reports of Better Chromium Plating

Three ways to "stop-off" for chromium plating

The method generally used in most plants is direct application of an insulating material on the work. The hot dip wax-type Unichrome Stop-Off Compounds, and the quick drying Unichrome Stop-Off Lacquers are favorites here. They're easy to use, hold a sharp line. Others prefer wrapping Unichrome Vinyl Tape around the stopped-off areas. This is fast, convenient, easier to remove. For shielding, formed shields coated with Unichrome Coating 218X, or made from Unichrome Rigid Resist Materials, do an outstanding job—saving time, work and materials.

Platers, too, now benefit from TANTALUM heating equipment

Tantalum is unique. It is actually acid-proof to all commonly used plating room acid solutions except hydrofluoric. It's hard, has high heat conductivity, and resists thermal shock. In the chemical industry, these properties have resulted in over 10 years' service in equipment designed for only 5.

United Chromium made this money-saving metal available to the plating industry in Unichrome Heating Coils and Exchangers with tantalum pipe. Though initially costing more than lead, this enduring equipment can virtually pay for itself by avoiding replacements of lead coils, downtime for installation and maintenance. Ask for more information about this equipment.

HOW TO KEEP CHROMIUM PLATING ANODES ON THE JOB

Chromium plating anodes create no problems where they've been specified with three features that promote good operation:

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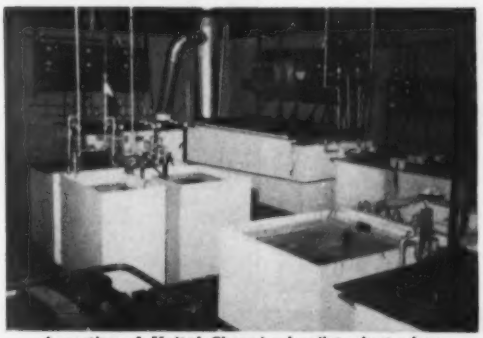

A portion of United Chromium's pilot plant where Unichrome SRHS Chromium Baths were developed

BETTER SPEED—BETTER ADHESION

An automotive supplier reported three benefits of using the Unichrome SRHS Bath for plating piston rings. It plated in half the time formerly required in the ordinary solution. The quality of the chromium deposit was better suited to the purpose. And the plate adhered more strongly to the cast iron base.

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Plating foreman at another company tells of substantially reducing burning on sharp edges and practically eliminating color buffing since installing the Unichrome SRHS Bath. (This is due to the wider bright plate range of the bath. It means less "burning" or "missing"—fewer rejects.)

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An automotive company compared shock absorber pistons that had first been plated in an ordinary chromium solution and then buffed, with those that had been plated in the Unichrome SRHS Bath. The smoothness of the unbuffed parts was equal to or better than the buffed samples. Here was good proof that the leveling action of SRHS Chromium smooths over minor surface irregularities.

BIG SAVINGS REPORTED

At a well known Connecticut plant, the plating superintendent compared cost figures. Since turning to the Unichrome SRHS Bath, he has been able to show a 30% reduction in operating cost. Also a 5% to 7% reduction in misplates that result from burning, double plate and poor coverage.

★ ★ ★

As these cases indicate, there has been a big difference made in the chromium plating operations of many plants—all through adoption of the Unichrome SRHS Bath. These case histories tell just part of the story. As a self-regulating bath, Unichrome SRHS also minimizes control problems. It maintains itself in peak plating balance. It deposits with less treeing. Through higher cathode efficiency, it also cuts power requirements and increases capacity without extra equipment.

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plating

April, 1953 Vol. 40, No. 4

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This month's cover picture shows a drum loading position in a chromic acid flake manufacturing process.

Published by the American Electroplaters' Society. Publication Office: 5800 N. Marvine Street, Philadelphia 41, Pa. Phone: LIvingston 8-7800. Editorial, Advertising and Executive Offices: American Building, 445 Broad Street, Newark 2, N. J. Phone: Humboldt 2-3400. Subscriptions: Domestic and Canada, $4.00 for 1 year, $7.00 for 2 years; 50c per copy; Foreign, $8.00 per year; $1.00 per copy.

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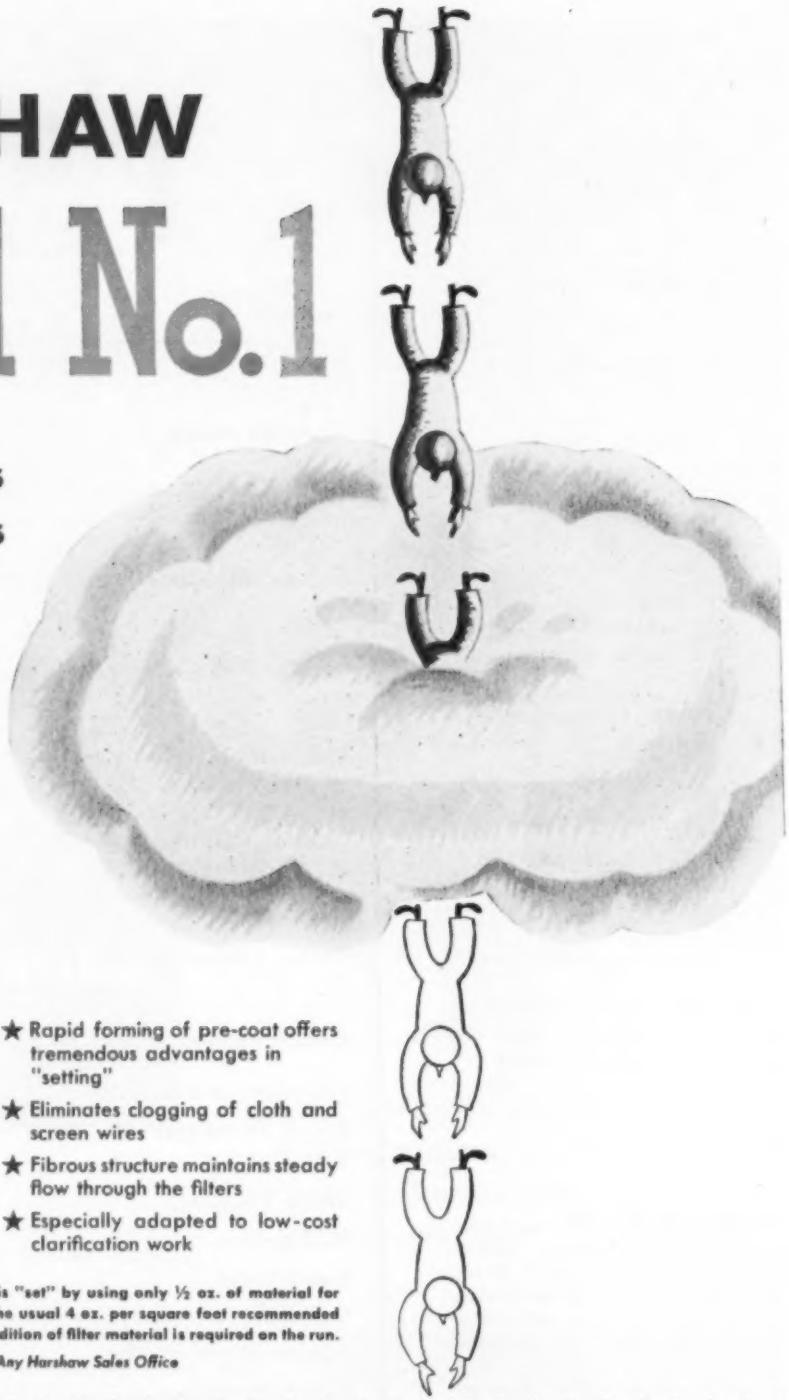

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Editorial

Safety Is No Accident

THOUGH INDUSTRIAL SAFETY in this country has advanced steadily over the past decade, large numbers of employees go right on being injured or killed every year. Accidents will not be eliminated by safety rules alone because new employees may not have sufficient awareness of potential hazards and older employees tend to minimize those dangers as a result of the overconfidence of familiarity. Safety is simply a full time job for everyone.

With the traditional season now at hand for the consideration of cleanliness, order and a proper place for everything, all safety essentials, a reminder is presented that calls for a survey of on-the-job safety conditions. No plater, technician, engineer or shop owner should ignore even the most trivial appearing requirement since safety is a sound business procedure that results in improved efficiency and improved employee morale.

Acids, cyanides and solvents should be properly labelled and stored; protective equipment should be inspected and replaced if found defective; and first-aid stations should be checked for orderliness. Numerous items could be included on any safety checklist, however a combination of good sense and the employment of safety aids, coupled with a continual alertness for potential dangers will produce results that show safety is no accident.

Al Korbelak

"Why"

AS APPLIED TO CYANIDE ZINC PLATING

THOMAS J. MENZEL*

Introduction

The word why is admittedly small but when applied to the electrodeposits obtained in a plating room, it can become most thought-provoking. For example, "Why is the deposit dull?", "Why is the deposit rough?", "Why is the deposit thin?", "Why is the deposit blistered?", and the many other "whys", the plater has heard too often.

In a general sense, the answers to these "whys" are obtained from experience and knowledge. The plater's fund of knowledge may be enlarged by reading technical articles and by attending the meetings of technical groups devoted to the industry. However, the most pertinent findings are obtained by personal experience in the plating department. The following text is a review of some of the author's knowledge on the subject of zinc plating troubles and cures.

When a zinc plating solution is operating satisfactorily, all the conditions about the bath should be observed, and carefully noted. A seemingly petty consideration of observing and recording the bath temperature may appear to be of little significance yet the neglect of this small detail may at some time prove costly. Employing a dial or floating thermometer may suffice, but could result in false economy. Automatic indicating temperature controls have proved their value over and over again in the reduction of losses from tank loads of ruined work. Other details of equal importance are voltage, amperage, cathode current density and anode current density. Knowledge of the concentration of bath constituents and their correlation to the conventional Hull Cell and bent-cathode plating tests is exceedingly valuable in the continued maintenance of proper control of plating solutions. A word description of the appearance of a properly corroding zinc anode or the correct amount of gassing at the cathode is generally inadequate. However, the plater can and should obtain good mental pictures of those conditions. The knowledge gained from the observation of the appearance and color of properly corroding anodes, from a study and estimate of the degree of gassing at the cathode, from the observation of the appearance of the color and clarity of a beaker sample of plating solution, and from the observation of the results of a prolonged (10–20 seconds) ½ per cent nitric acid bright dip test of a zinc plated part pays off in dividends of continued trouble-free production.

Dull Deposits

Probably the most important of the questions listed in the introduction above is the one—"Why is the deposit dull?". The answer to this and the other queries can best be obtained by running through the following check list of questions and answers.

Has the bath been analyzed and have plating tests been conducted? Are the concentrations of the constituents within formula amounts? A low sodium cyanide to zinc ratio or a high sodium hydroxide concentration could be responsible for dull coatings.

What is the bath temperature? Elevated temperatures will cause a dulling of deposits and also will result in the break-down of many proprietary brighteners.

If the solution is in chemical balance and the temperature is proper, then the dullness of deposit may be caused by impurities in the bath. This fact may be confirmed by a prolonged ½ per cent nitric acid bright dip test of a plated part. If the deposit turns darker or possibly black, there is indicated a heavy copper contamination which may be corrected by a zinc dust treatment (1–5 lbs/100 gallons).

Removal of Copper Contaminants

This purification step is best carried out by transfer of the plating bath to a spare tank. The required amount of zinc dust is then sprinkled on the surface of the plating solution following which the bath is thoroughly agitated for 2 to 4 hours. A mechanical stirring apparatus is recommended. The solution is allowed to settle for 6 hours, or overnight, and then filtered or decanted back into the production plating tank.

*Metal Finishing Consultant, Jack S. Steele Company, Matawan, N. J.

If the contamination is severe enough (above 0.2 oz/gal of copper as metal) it may be necessary to precede the zinc dust treatment with solution-agitated low current density electrolysis (2 amperes per square foot) on corrugated dummy cathodes. After dummying the bath two or three hours, a study of the deposit being obtained may show a difference in color in respect to the recessed or low current density areas and the protruding or relatively higher current density areas on the corrugated dummy. If the recessed areas are dark or black and the high current density areas are reasonably light in color then the current density on the dummy cathodes should be adjusted from 2 amperes per square foot down to 1½ amperes per square foot. This will result in a greater quantity of the inorganic impurity being removed per ampere hour. On the other hand, if the high current density areas of the dummy are dark or black and the recessed areas light in color, the cathode current density should be increased from 2 amperes per square foot up to 2½ to 3 amperes per square foot. After further electrolysis, the deposit color should again be noted and the current density then adjusted as outlined above.

The manner in which the anodes are corroding may sometimes give a clue to bath impurities. When the anode current density is proper, and the anodes are discolored or unreasonably sludged, the cause may be metallic impurities. Lead in the bath will cause excessive sludging of the anodes and if cadmium is present it will cement out on them. A sodium sulfide or polysulfide treatment (15 oz/100 gal) and a zinc dust treatment will correct this condition. The sulfide salts should be dissolved in water prior to their addition to the zinc solution.

Is the zinc deposit stained? This question, relating to a surface color appearance, is best answered by a careful check of the rinsing steps between treatments. Too often, contaminated rinse waters may be the cause of such a defect. Another reason may be found in the fact that when light-gage work is being processed many platers dry the parts in sawdust after hot water rinsing. A hard wood sawdust is generally preferred to avoid the tendency of softwood sawdust staining.

Rough Deposits

Why is the deposit rough? The bath should first be analyzed to see that it is in chemical balance. Then, the usual reason for rough or sandy deposits is the presence of suspended particles in the solution and the top side of a shelf section of the work is the most likely place to find such a condition. A representative sample of the solution should be taken in a beaker and checked for any suspended particles. If the anodes are sludging excessively, metallic fines and black flakes will be seen in the sample. This condition may be caused by anodes of inferior quality, improper anode current density, or the result of metallic impurities present in the bath causing an accelerated attack on the anodes through galvanic action. If all conditions about the plating solution appear perfectly normal, yet roughness of deposit continues, then the basis metal being plated and its surface condition upon entering the bath should be considered. The removal of suspended particles in the plating solution is accomplished by filtration. Of course, the proper filtering medium in the filter must be provided. In the case of high caustic and cyanide solutions, filter aids such as diatomaceous earth that would release silica into the plating bath should be avoided. Filterbestos is generally preferred as a filter aid in the cyanide zinc solution.

Thin Deposits

Why is the deposit thin? Again, the analysis of the solution should be known and the cathode should be checked for excessive gassing. Gassing at the cathode means the liberation of hydrogen at that pole or lowered cathode efficiency and, of course, as the degree of gassing increases, the amount of metal being deposited decreases proportionately. A zinc solution having a high sodium cyanide to zinc ratio or a low metal concentration will cause excessive gassing with a result that thin deposits will be obtained. If the gassing at the cathode is somewhat feeble, very likely the cathode area is larger than calculated and more current should be applied. The effect of temperature on cathode efficiency should not be overlooked. Elevated temperatures (90–140° F) are required for higher cathode efficiencies in a zinc solution. Low operating temperatures (40–60° F) will have the adverse effect on cathode efficiency.

Breaks in insulation of tank linings, ground shorts and other stray current phenomena will result in thin deposits. Therefore, the plating equipment should be checked for these possible defects. Another possible factor in thin deposits or those lacking uniformity is that of racking. The rack and contact points should have sufficient current carrying capacity. The frame, spine and cross sections should be insulated in order to avoid thieving of the metal deposits from the work. The manner in which the parts are racked is most important. Contact should be so made that shading is reduced to a minimum. Uniformity of deposit will be affected by the position of the work so that work plated back to back will result in thinner deposits on the inside portions. If the parts are spherical or box like, they should be positioned so that the opening is tilted upwards in order to avoid gas pocket formation.

Blistered Deposits

Why is the deposit blistered? The cleaning cycle must be considered in this case. Is the work clean? Has it been pickled properly? If it is possible, a few pieces of work plated in a different plating solution, but using the same cleaning cycle, will rapidly point up whether or not the cleaning cycle is at fault. If it

(*Continued on page 377*)

RADIOACTIVE TRACERS TRACK METAL CLEANING EFFECTIVENESS*

J. W. HENSLEY†

Introduction

Cleaning operations in the metal finishing industry become more and more complex as the variety of substances to be removed increases. Because of this, greater emphasis is being placed on research in the metal cleaning field. Such research, often involving reactions at surfaces or solid-liquid interfaces, is difficult because of the number of variables involved. Negligible quantities of materials concentrated on a surface or at an interface, can have an effect out of proportion to the quantity of material involved. An example occurs in electroplating where trace contaminants on the base metals may have a pronounced effect on results.

To measure such small quantities of materials, often immeasurable or even undetectable by conventional test methods, a new sensitive technique, for quantitative measurement of trace quantities of materials is of considerable interest. Radioactive tracers provide a technique capable of extreme sensitivity and quantitative measurements of trace quantities without the limitations and complications usually inherent in highly sensitive, quantitative methods. For several years Wyandotte Chemicals Corporation has been working with radioactive tracers in various fields of detergency research.

Tracers are used to advantage in several ways. Cleaner components, normally alkalies and surfactants, are tagged by synthesizing with radioactive atoms and used to determine filming characteristics and adsorption on metal surfaces. Tagged solutions are used to measure the rate at which a cleaner component is rinsed from metal surfaces.

Metals are tagged (by bombarding in an atomic pile) and used to study corrosion, attack by cleaners, and the action of inhibitors in cleaners. Another application is in tests for evaluation of cleaning effectiveness using soils tagged with radioactive atoms. Here the radioactivity, which is proportional to the amount of tagged material present, is used to measure the removal of soil from a metal surface.

In devising a cleaning test using tracer methods, prime considerations are the choice of soil and the method for incorporating the radioactive tag. To have a valid tagged soil, radioactive atoms must be incorporated in the molecules of the soil component to be studied. In the case of organic materials, the desired compounds must generally be synthesized with the incorporation of radioactive atoms.

Soils encountered in metal cleaning operations are almost infinite. The most suitable application of tracers seemed to be in connection with processes in which the last traces of soil must be removed for optimum results, as where metals are cleaned prior to electroplating. Soils most commonly encountered are materials applied to the metal in previous operations, such as buffing compounds and cutting oils. These soils frequently consist of combinations of hydrocarbons, including mineral oils and waxes, fatty acids and derivatives, tallow, vegetable oils, etc., and particulate matter, such as abrasives, metal, and carbon particles.

Of these, fatty acids generally are considered troublesome. There have been no satisfactory quantitative methods for studying removal of residual films of fatty acids. Frequently present in buffing compounds and polishing materials, their affinity for metals provides desirable characteristics, but also makes them difficult to remove. Fatty acid films may also be deposited on metals from preliminary soak cleaners containing soap. Such films must be removed by subsequent cleaning operations.

Radioactive fatty acids, synthesized with carbon-14, may be purchased from several sources, with authorization from the Atomic Energy Commission. Tagged stearic acid was chosen for first investigation. Soil types other than fatty acids are being investigated, but the bulk of the work so far has been done with tagged stearic acid, and this discussion will be limited to that soil.

---

*Reprinted from The Iron Age, November 13, 1952.
†Manager, Nucleonics Laboratory Research and Development Division, Wyandotte Chemicals Corporation, Wyandotte, Mich.

Tagged Stearic Acid Soil Used

In most of the work, tagged stearic acid has been used alone as the soil. Some trials have been made with combinations of the stearic acid with various types of oil, in order to determine whether the presence of oil would have any pronounced effect on the removal of stearic acid in the cleaning process. Under the conditions investigated, removal characteristics of the stearic acid appear to be essentially the same whether used alone or combined with mineral oil. The metal cleaning test procedure using tagged stearic acid soil has been described in detail[1].

Metal disks, 1.5 inch in diameter, after preliminary cleaning with solvent, are machine abraded to provide a clean surface with a reproducible finish. The tagged stearic acid soil is applied as a solution by the apparatus shown in Fig. 1.

Five microliters of solution are spread in a thin, continuous film on the disk. After the solvent is evaporated, a thin film of stearic acid remains which is essentially uniform and highly reproducible. Radioactivity on the metal surface is measured with Geiger counting equipment shown in Fig. 2. This initial measurement or "count" on the soiled piece is merely a check, as a constant, known amount of stearic acid is applied. Initial count from one disk to another is essentially constant. The piece is then cleaned by a standardized procedure, rinsed, dried, and the final count taken.

Since radioactivity, stated as counts per minute, is proportional to quantity of stearic acid on the surface, the final count provides a relative evaluation of cleanliness, without converting counts per minute into weight of soil.

It should be appreciated, however, that counts per minute for a given quantity of radioactive material depends on location of activity with respect to the Geiger tube, Geiger tube characteristics and distribution of activity on the sample surface. Several counts on the same kind of radioactive substance are directly comparable only when taken under identical conditions.

Although simple in principle, this test method is so sensitive that slight variations in procedure can produce large variations in results. All variables must be standardized and carefully controlled. Especially critical is the surface finish of the metal to which the soil is applied. This factor has given more difficulty than any other in the development of this test method. It has not yet been possible to obtain an entirely constant surface condition. Frequent checks with standard cleaning solutions selected as references are necessary.

Several variables involved in removal of this fatty acid type soil from steel and from brass by simple immersion cleaning and by electrocleaning procedures have been studied. More than 2500 tests have been made with individual cleaner components and compounded cleaners. Effects of concentration, cleaning time, current density and direction have been determined. Effects of surface finish and surface treatments

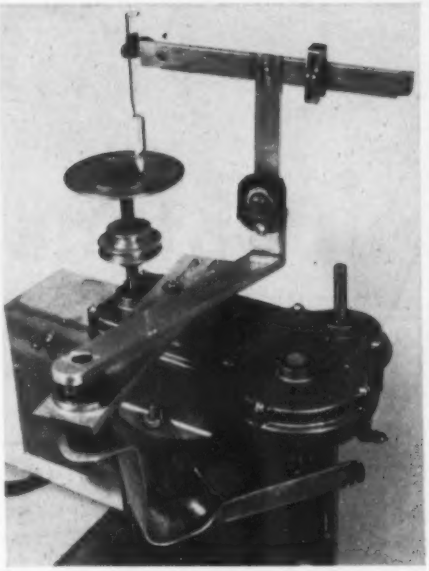


Fig. 1. A measured volume of radioactive stearic acid soil solution is spread over a metal disk automatically. Solvent is evaporated, leaving a solid fatty acid film

on soil removal, and the removal of the soil during the rinsing and acid dipping processes have been determined.

Fig. 3 shows the rate of removal of the stearic acid in electrocleaning steel anodically in a sodium metasilicate solution as compared with a compounded electrocleaner solution. The rate of soil removal by the compounded cleaner during the first minute is appreciably more rapid than by sodium metasilicate. After 8 minutes cleaning, the compounded cleaner left one-

Fig. 2. Measurement of radioactivity. Soiled steel disk is placed on sample support, which slides under the window of a Geiger tube, inside a lead shield

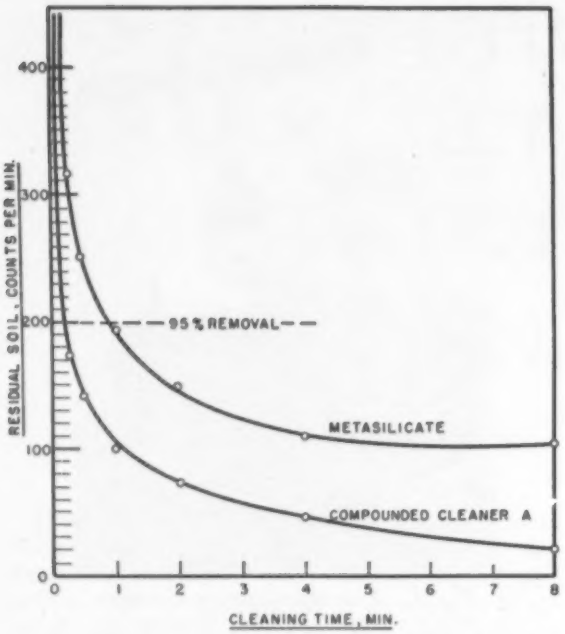


Fig. 3. Comparative rates of removal of tagged stearic acid soil from steel disks by anodic electrocleaning in a sodium metasilicate solution and in a solution of a compounded cleaner

fifth as much residual soil as the sodium metasilicate. The metasilicate (anhydrous) and the compounded cleaner were used at concentrations of 8 oz/gal, both having approximately 3 per cent titratable Na_2O in solution, with *p*H values between 13 and 14.

Fig. 4 illustrates a type of study carried out with all the common alkalies, and with many compounded cleaners. Here, the effect of concentration was determined with constant cleaning time and current density. Base metal was brass. There is a pronounced rise in residual soil (or decrease in cleaning efficiency) as the soda ash concentration is increased above a certain optimum value.

Similar results are obtained with other commonly used alkalies, with a rise in residual soil at concentrations above 2 to 4 per cent titratable Na_2O in solution. The effect is found in cleaning steel or brass, and is more pronounced in cathodic than in anodic electrocleaning. It is even more pronounced in simple immersion cleaning than in electrocleaning. In contrast, the compound cleaner shows no decline in cleaning effectiveness at concentrations up to 16 oz/gal.

Another way in which the radioactive tracer method can be used is shown in Fig. 5. Radioautographs of the tagged stearic acid soil on steel disks have been obtained by placing the surfaces of the disks in contact with no-screen X-ray film and exposing for several days. In Fig. 5 A, a soiled disk was electrocleaned in concentrated soda ash solution for a short period, leaving a high residual soil of about 600 counts per minute. Soil removal is non-uniform, leaving a spotty appearance. The autograph of stearic acid adsorbed on the steel surface is shown in Fig. 5 B. In this case, a clean steel disk, polished in the usual way, was immersed in a tagged soap solution (sodium stearate plus excess caustic) for ½ minute at 90° F, then rinsed thoroughly. The stearic acid (or stearate) has adsorbed in a non-uniform manner, indicating variations in the nature of the steel surface, even though the polished surface was considered uniform.

Conclusions

The tests have been used primarily to supply basic research data and are not intended, at the present stage of development, to provide a method for routine comparison and evaluation of commercial cleaners for practical use. Field performance of a metal cleaner

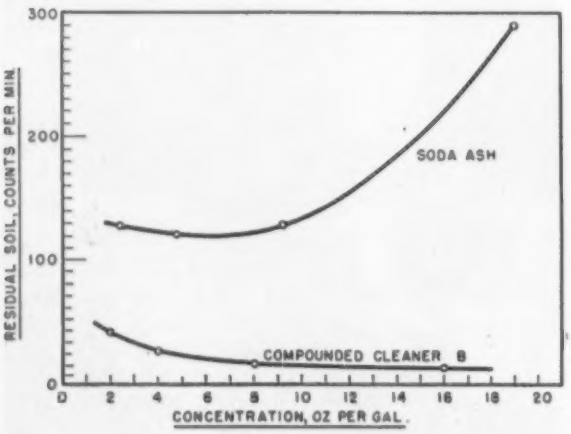


Fig. 4. Effect of concentration on removal of tagged soil from brass by anodic electrocleaning in a soda ash solution and in a solution of a compounded cleaner. Cleaning time, 1 minute, at 25 amp/sq ft

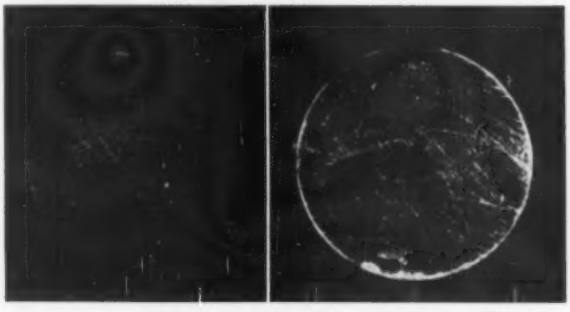


Fig. 5. Radioautographs of tagged stearic acid on steel test disks: Left: residual soil on disk electrocleaned in soda ash solution; Right: stearic acid adsorbed on clean steel from a radioactive soap solution

(Continued on page 377)

Chromic Acid Manufacture

EUGENE L. COMBS*

Introduction

All chromic acid produced in this country is made by reacting bichromate of soda with sulfuric acid. Bichromate of soda is the end-product of a process involving chromite ore, soda ash, lime, water and sulfuric acid. The process with improvements in equipment, controls and techniques has been used for over 25 years. The pictures† show a modern adaptation of this process.

Chromite Ore

Chromite ore is available in many locations throughout the world, but there is a wide variation in grade. That which is most suitable for the production of chromium chemicals is referred to as chemical grade ore, and comes chiefly from the Transvaal area of the Union of South Africa. An average analysis of chemical grade chromite is as follows:

		Per Cent
Chromic Oxide	Cr_2O_3	44.18
Ferrous Oxide	FeO	19.01
Aluminum Oxide	Al_2O_3	14.74
Magnesium Oxide	MgO	11.48
Silica	SiO_2	3.53

The chromite ore is purchased on an assay basis through importers who have several sources of supply. The chromium chemicals producing companies maintain large inventories of the ore to offset the transportation hazards from the mines. Shipment from the mines to the port is by a single track railroad because of the terrain. When the demand for chromium chemicals is greatest, other materials are also in emergency supply and there is considerable competition for ore boats.

Beginning in 1946, there has been a steady gain in the world production of chromite ore. The Union of South Africa has more than doubled production. The Philippines have better than quadrupled their production while Cuba has experienced a slight decline. The production position of Southern Rhodesia, Turkey and New Caledonia has strengthened. Yugoslavia has shown a substantial gain in production while Russia has produced a large but fluctuating output. Other countries such as India, Sierra Leone, Greece, Cyprus, Bulgaria, Canada, Japan, Albania and Brazil have turned out lesser quantities of chromite ore.

The total world production of chromite ore is approximately 2½ million short tons. The United States imports from 22 to 50 per cent of this amount with chromium chemicals production requiring from 7 to 18 per cent of the imported ore.

The Manufacturing Process

Grinding and Roasting

The chromic acid manufacturing process is essentially the conversion of chromite ore to sodium chromate solution, to bichromate of soda crystals, to chromic acid. The chromite ore, containing 42–50 per cent Cr_2O_3, is first dried and ground to a maximum coarseness of 100 mesh. This preparation increases the efficiency of the succeeding reaction step of the process.

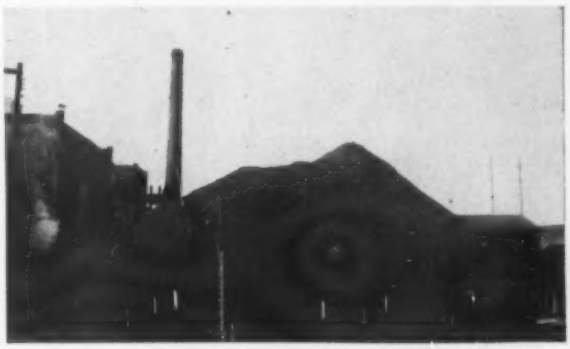


Fig. 1. One of several chromite ore stock piles required to assure continuous operation of one chromium chemicals plant. Chromite ore resembles crushed coal in its physical characteristics

*Technical Service Division, Diamond Alkali Company.

†Pictures taken at the Kearny Plant, Kearny, N. J.

Fig. 2. The kiln room showing the firing end of the roasting kilns in which the first chemical reaction required in the production of chromic acid takes place. Note the well-lighted control panel and working area. Good ventilation and ample space to encourage neatness is provided. The rotary kilns compare in size and design to the "mud" dryer shown in another photo

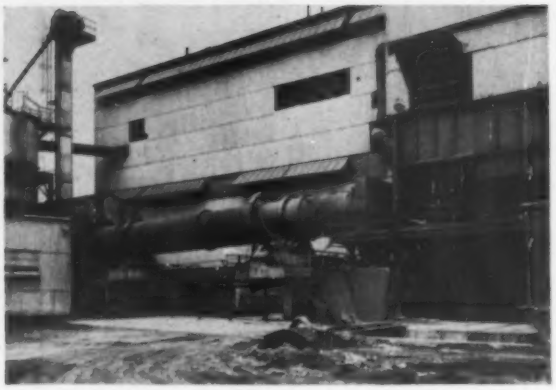


Fig. 3. The residue or "mud" from the leaching step in the process is dried in this rotary kiln and passed into a crusher where it is reduced to a size suitable for re-use in the process

The dried and ground ore is mixed with soda ash, and lime or ground filter residue from a previous operation. The ingredients are thoroughly blended in rotary mixers.

The mix is roasted in rotary kilns for about four hours in an oxidizing atmosphere, at a closely controlled temperature of 1094–1149° C (2000–2100° F).

Sodium Chromate Step

After leaving the kiln the roast is cooled and then transferred to a leacher where water is added and a nearly saturated solution of sodium chromate and sodium aluminate is obtained. The residue from leaching contains the iron, magnesium and silicon impurities in the ore. Part of this residue, called mud, is dried and ground for use in future mixes and the remainder is discarded.

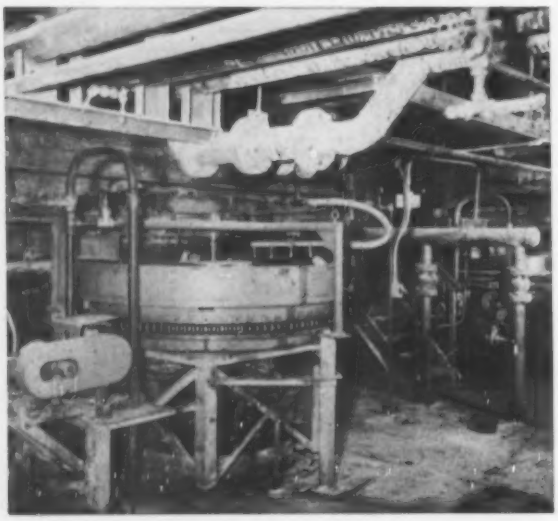


Fig. 4. The precipitated sodium sulfate is removed in these horizontal rotary filters. The precipitate is washed, dried and marketed

The leached sodium chromate-sodium aluminate solution is passed through a polishing filter to remove traces of suspended matter and then pumped into batch hydrolyzing tanks. Here sodium chromate solution is slowly added to the sodium chromate-sodium aluminate solution to crystallize hydrated alumina. The alumina is separated and washed on filters and either dried and marketed as such, or the wet filter cake is dissolved in sulfuric acid and converted to aluminum sulfate.

The purified sodium chromate solution is either sold as a 40° Baumé solution, evaporated to produce anhydrous or hydrated sodium chromate crystals, or converted to bichromate of soda.

Sodium Bichromate Step

To produce sodium bichromate, the 40° Baumé sodium chromate solution is treated with 66° Baumé sulfuric acid. Approximately half of the sodium sulfate formed in this reaction is precipitated during mixing and the remainder drops out in the evaporator to which the solution is pumped for concentrating. When a concentration of 13.5 to 14.0 lbs $Na_2Cr_2O_7 \cdot 2H_2O$ per gallon is reached, the solution is pumped into a battery of watercooled crystallizers. When the temperature of a crystallizer falls to 35° C (95° F), the batch is centrifuged and the mother liquor is either sent back to the evaporators, the hydrolyzer, or sold in tank cars as a saturated solution containing 70 per cent by weight, $Na_2Cr_2O_7 \cdot 2H_2O$. The crystals are dried

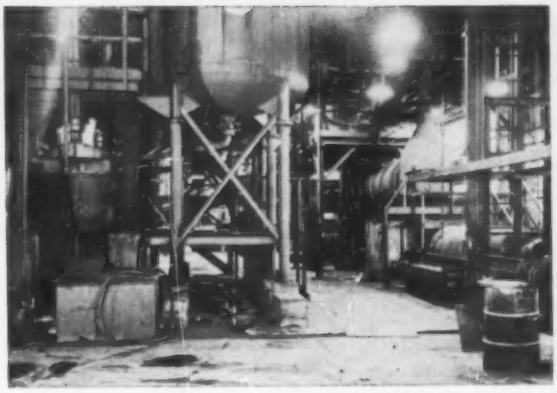


Fig. 5. The crystal department where bichromate of soda crystals are produced. The crystals are removed from the mother liquor in large centrifugal filters, one of which can be seen to the left of Tank No. 2. The crystals are washed in the centrifuge, removed and transported to the crystal dryer and cooler by belt conveyors

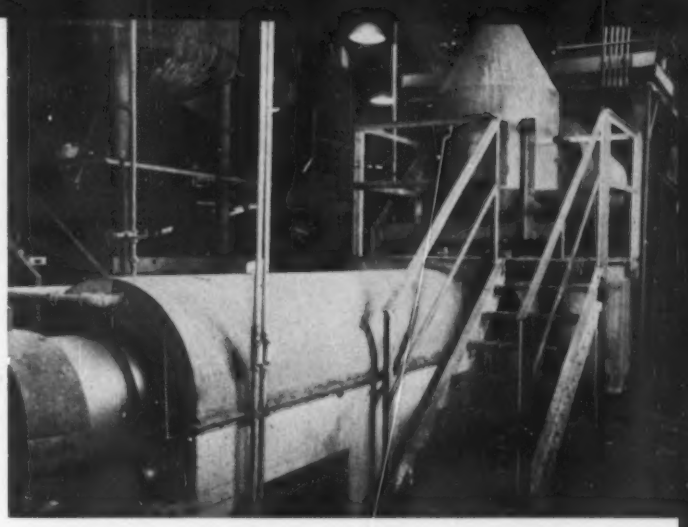


Fig. 6. Close-up of the crystal dryer and cooler. Careful control is exercised to maintain a product containing the correct amount of water of crystallization

in rotary dryers, care being taken not to drive out the water of crystallization.

Chromic Acid Step

In the chromic acid process, bichromate of soda crystals are mixed with either 66° Baumé or fuming sulfuric acid in a kettle equipped with an agitator. Fuming sulfuric acid absorbs the water of crystallization while this water has to be evaporated if 66° Baumé acid is used. The temperature of the mix is raised to 197° C (387° F) at which point the entire mass containing chromic acid and sodium bisulfate is in the molten state. Chromic acid, being heavier than sodium bisulfate, collects at the bottom and is drawn off and passed through water-cooled flaking rolls and packed in steel drums. The sodium bisulfate contaminated with chromic acid is run out into pans to solidify before being discarded.

The care exercised in the separation of the chromic acid from the sodium bisulfate determines the sulfate content of the chromic acid. The quality control laboratory analyzes the ingredients for each batch and the reaction time is adjusted, if necessary. The chromic acid is analyzed for CrO_3 content and impurities. The individual drums of chromic acid are rapidly segregated by a sulfate analysis. All material showing sulfate higher than standard is rejected and reprocessed.

One hundred pounds of bichromate of soda yields 62.4 lb of salable chromic acid, which is 93 per cent of the theoretically available amount. Loss in the bisulfate is about 5.5 per cent and up to 1.5 per cent is lost in dust and handling. The weight of the contaminated bisulfate produced and discarded is essentially equal to the weight of the bichromate of soda used.

It has been shown that the chromite ore contains iron, aluminum, magnesium and silicon in addition to chromium oxide. Of these impurities only aluminum is obtained in a salable form. The reason for using chemical grade ore is quite evident, since ores high in silica, iron, and magnesium mean the payment of freight on materials destined to be discarded as waste products.

The impurities in the chromite ore are removed in the manufacture of bichromate of soda. This material

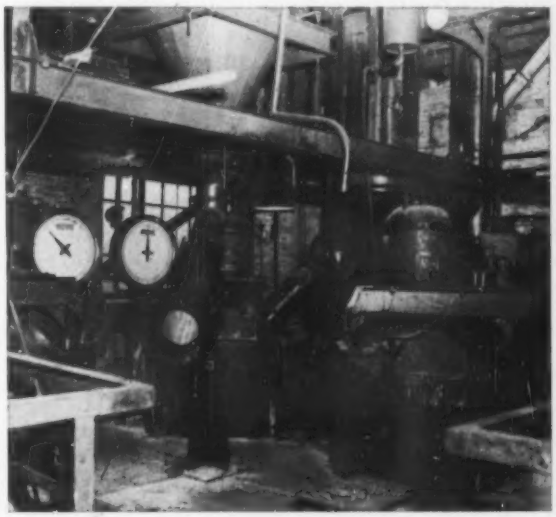


Fig. 7. Fusion kettles used in producing chromic acid. The weights of bichromate of soda and sulfuric acid used in each batch are controlled by means of the scales shown in the background. The bichromate of soda crystals are added to the kettles by means of the pipe chute shown in the center of the picture. This chute revolves so as to service each kettle

Fig. 8. Chromic acid flakes pass directly from the flaker into the drums. An exhaust duct located behind the drum carries away the dust. The operators wear face shields, and respirators and keep their bodies well covered. Note how they fasten the bottoms of their trousers to protect against dust or splashing. A roller conveyor carries the filled drum to the weighing, sealing, and labelling department

has been produced for sale in a highly competitive market for many years. Hundreds of man hours have been expended over these years to produce as pure a technical grade of bichromate of soda as it is chemically possible to achieve. This same bichromate of soda is used in the chromic acid process. The principal problems concerning the purity of chromic acid are in heating the kettle and in the separation of the sodium bisulfate and chromic acid layers. The temperature and time are controlled by instruments. A mistake at this point may cause the formation of undesirable complex chromium compounds. The correct separation of the layers controls the sulfate content. This separation is performed manually by a trained operator. The operator is double-checked by an analytical chemist and any chromic acid containing high sulfate is reprocessed.

Chromic acid is sold in flake form because it is the most economical anhydrous form to produce. The flake is friable and, in shipment, some of it breaks up into a powder so that the farther the material is shipped, the more powder may be found in a drum.

Two container sizes are packed. One hundred pound drums are more convenient for the electroplating industry, while the 400 pound drum has proven more satisfactory for those industries using chromic acid to manufacture other chromium compounds.

Uses for Chromic Acid

Metal Finishing Industry

Of the twenty million or more pounds of chromic acid produced annually, approximately 70 per cent is consumed by the metal finishing industry. This amount includes, in addition to chromium plating and anodizing, material used in the compounding of conversion coatings for zinc and cadmium surfaces, surface treatment products for aluminum prior to painting, a sealant for phosphatizing processes, and oxide control treatments for aluminum prior to spot welding. Other metal finishing uses which consume considerable chromic acid are chromidizing, chemical polishing baths, bright dips for copper and brass, and the stripping of the copper stop-off after selective carburizing. A unique application is the preparation of an aluminum surface to promote the adherence of a special porcelain enamel.

Pigment Industry

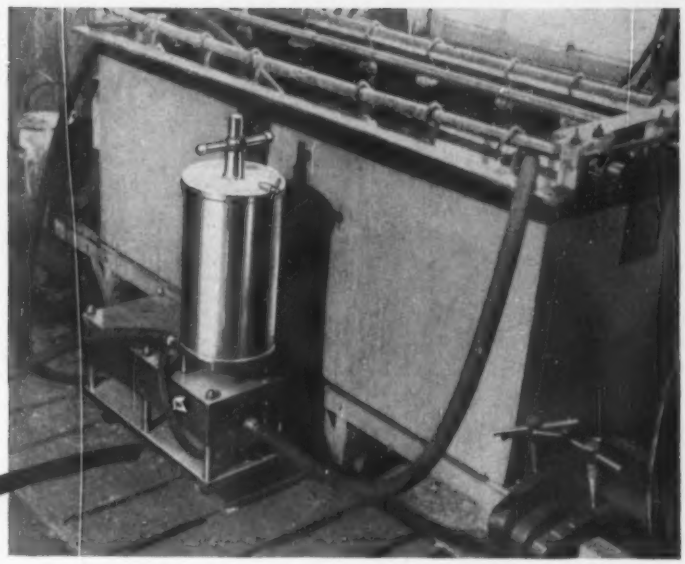
Approximately 20 per cent of the chromic acid is used by the pigment industry. Shades of yellows and greens not possible with bichromate of soda are produced by using chromic acid. Most important today is the production of a salt-free zinc chromate made

(*Continued on page 377*)

Fig. 9. A section of the air-conditioned quality control laboratory. A careful check of each step in the production of both chromium chemicals and the by-products is made by the laboratory staff

Fig. 10. The fast loading of a truck speeds the chromic acid to the consumer

CHECK the advantages of using a "Sealed-Disc" Filter



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Small, compact . . . requires exceptionally small floor space coupled with remarkable filtering speed and volume.

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Regardless of the size or type of your installation, there's a "Sealed-Disc" Filter "to fit your job"—you can depend on these proved performance features—you can be sure that all dirt, dust, sludge and even the invisible impurities are removed from your plating solutions.

"Sealed-Disc" Filters were designed especially to meet plating room requirements. They are smaller, more compact and portable than ordinary filters, yet they are capable of handling equal volumes of solutions. Ask your regular plating supplier to tell you about the "Sealed-Disc" Filter that has helped so many platers get better finished plated work with savings in time and labor—or write for details.

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These Rectifiers—*made* by H-VW-M—have a smooth, easy-to-clean, durable, grey, hammer-tone finish and are the most complete line in the industry. They're available with either self-contained or remote control, in a full range of sizes from 50 to 10,000 ampere units in all desired voltages. And by comparison, *they cost less per unit than any other rectifiers made!*

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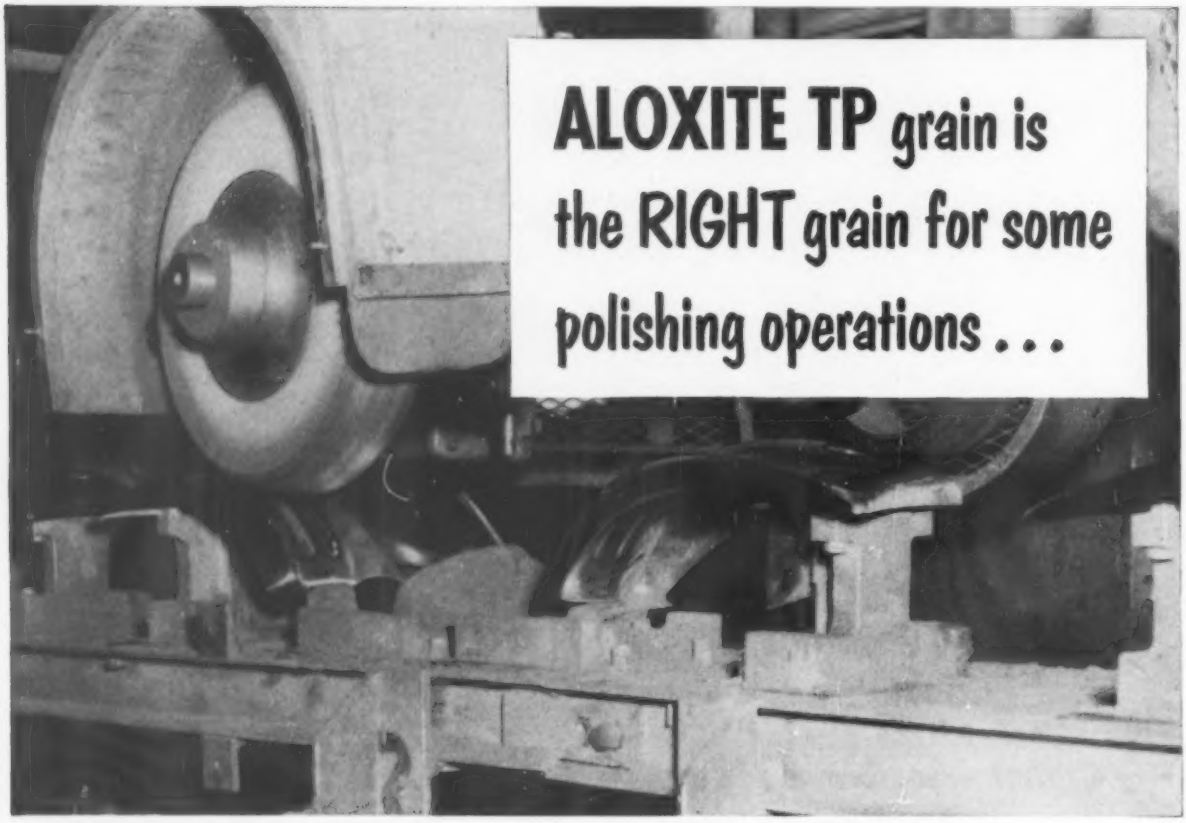

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. . . and the right one for EVERY operation is among the other six in the complete line by CARBORUNDUM

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GRAIN TYPE	CHARACTERISTICS	PRIMARY USES
ALOXITE TPT Aluminum Oxide	Tough, sharp. Grits 16 through 100.	Polishing operations involving removal of large amounts of metal.
ALOXITE TPL Aluminum Oxide	Very sharp, friable. Grits 16 through 220.	Polishing low tensile strength metals—copper, brass, bronze, aluminum.
ALOXITE TPC Aluminum Oxide	Medium sharp. Grits 16 through 220.	General purpose polishing grain—for removal of small amounts of metal.
ALOXITE TPW Aluminum Oxide	Powder. Grits 240 through 1000.	As the abrasive in paste heading of polishing wheels and belts.
CARBORUNDUM RA Silicon Carbide	Sharp, very friable. Grits 10 through 240.	Polishing cast iron.
CARBORUNDUM RA Silicon Carbide	Powder. Grits 280 through 600.	General purpose polishing.

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83-52R

Radioactive Tracers

(*Continued from page 368*)

depends on a number of factors, aside from completeness of removal of a specific soil, which must be taken into account in making an evaluation. The method does, however, provide a sensitive and versatile means for evaluating cleaning effectiveness. Any laboratory test method must be correlated with practical cleaning results under plant conditions before it can be considered reliable.

Absolute residual soil left by a given cleaner, as well as differences between cleaners, will depend on surface finish and other conditions selected for the laboratory test method. Significance of such results either on an absolute or relative basis must be determined by correlation with other types of laboratory tests and plant trials.

At present, tests are being made in which pieces carrying known amounts of soil, as determined by the tracer method, are electroplated, with subsequent measurement of the quality and adherence of the plate. This work will provide information on what constitutes a "clean" surface in a practical sense.

REFERENCE

[1]J. W. Hensley, H. A. Skinner and H. R. Suter, "A Metal Cleaning Test Using Radioactive Stearic Acid as Soil", Special Technical Publications No. 115, pp. 18–32, American Society for Testing Materials, 1952.

Cyanide Zinc Plating

(*Continued from page 365*)

is determined that the cleaning cycle is all right, then one must look for possible metallic impurities in the plating solutions. Anode corrosion may also furnish a clue. A brownish film on zinc anodes indicates the possible presence of chromium in the bath. In view of the wide use of proprietary chromic acid dips on zinc deposits, great care should be exercised to avoid contamination of the plating bath. Beckwith[1] has described the method of reducing hexavalent chromium to the harmless trivalent form by treating the contaminated cyanide solution with sodium hydrosulfite, $Na_2S_2O_4$, known commercially as Vatrolite or Lycopon.

In this paper a few "why" questions have been considered as applied to a cyanide zinc solution. Actually they and other similar questions may be applied to other plating baths as well. The answers to a great degree will be much less elusive if the teachings of others are combined with each and every plater's own careful observations and diligent concern to detail.

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Chromic Acid

(*Continued from page 372*)

possible through the use of chromic acid. This pigment is much in demand by the Navy as a corrosion inhibitor.

The remaining 10 per cent is consumed in various ways. One use is in the manufacture of catalysts for oil refining, and for the vegetable shortening industry. Another use is in the manufacture of medicines such as Cortisone. It is claimed that chromic acid makes an excellent binder for refractory brick, especially well suited for open hearth bottoms. Chromic acid will harden and waterproof hydraulic cement. The oxidizing properties of chromic acid make this material most popular in the chemical industry. Rubber manufacturers use strong solutions of chromic acid for the fast cleaning of molds.

New Uses

A steady flow of patent grants covering new uses for chromic acid is cited. One of the most recent is the mixing of chromic acid with an unsubstituted ethylene polymer to produce a prime coat for bonding ethylene polymer coatings to steel. Without chromic acid in the composition, best adherence could not be obtained; with it, a new line of high quality coatings is now possible.

The unusual behavior of strontium with or in the presence of chromic acid solutions has been used in Europe to make a corrosion inhibitor for absorption refrigeration systems. Strontium carbonate is reacted with chromic acid to form strontium chromate. The strontium chromate is added to the system in excess of the desired amount and maintains a maximum concentration of 0.2 per cent chromic acid, the inhibitor concentration being measured as chromic acid.

The wide range of applications for chromic acid is not only a function of the chemical properties of the material, but is also due to its purity and its physical properties.

In conjunction with developments of new techniques in producing chromic acid, and in quality control methods, the manufacturer has kept abreast of developments in material handling methods. Modern methods of handling material mean better service to industry.

Chromic acid will continue to serve the needs of the metal finishing industry regardless of the development of new uses. Recent plant improvements and expansions are aimed at anticipated future requirements of industry. Production is geared to research and will grow with developments.

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40th Annual A.E.S. Convention

The Technical Program

The Schedule

Last month a portion of the technical program for the June Convention was outlined. This discussion is continued to cover the rest of the papers not detailed in the previous article.

Educational Committee Chairman Fred Fulforth emphasizes that a balanced program has been planned to cover both practical and academic aspects with special emphasis on "what's new".

A new electronic thickness gauge will be discussed by Abner Brenner. This is an instrument which should greatly simplify the ever important problem of determining plate thickness.

In the same vein, C. F. Waite of King-Seeley Corporation will outline the procedures [illegible] required, to determine the thickness of chromium plate by the anodic solution [illegible]

Iron plating has been limited, to some extent, by the poor characteristics of the available plating baths. A newly developed alkaline iron plating bath appears to have overcome many of these difficulties. This bath is described in a paper by Foley, Linford and Meyer.

The symposium on chromium plating, outlined last month, will include a discussion on "A Corrosion Study of Chromium Electrodeposits" prepared by Brown and Hoover of the Udylite Corporation. This work is particularly interesting in that it discusses exposure tests of chromium plate on a variety of metals; a matter of strong interest in these days of substitute base plates.

While a [illegible] paper for [illegible]

abrasive polishing on nickel. A new technique for plating on molybdenum will also be presented.

The morning session will be preceded by the annual Secretaries' Breakfast and by the Speakers' Breakfast.

The Golf Outing is being held at the Merion Country Club Tuesday afternoon. This club is unique in that there are two complete courses, one for low handicap players and one for "advanced beginners". A film, "Corrosion in Action", will be presented on Tuesday evening. This is also the traditional time for suppliers to hold open house.

Wednesday, June 17, there will be just one technical session in the morning.

The Philadelphia Branch is understand[illegible]

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project no. 12

project director:
HENRY B. LINFORD*

associate
EDW. B. SAUBESTRE*†

location:
COLUMBIA
UNIVERSITY,
NEW YORK CITY

CLEANING AND PREPARATION OF METALS FOR ELECTROPLATING

V. OIL SPREADING RATES*

SUMMARY

The spreading rates of several oils on steel surfaces are determined. Oils which adsorb strongly to clean surfaces (e. g., oleic acid) spread least; non-adsorbing oils (e. g., mineral oil) spread rapidly. Fatty oils (e. g., lard oil) are intermediate in behavior. Spreading rates are higher on matte surfaces than on polished surfaces. Films of stearic acid render metal surfaces oleophobic; films of oleic acid render them oleophilic.

Cleaning index values obtained previ-

Evidence was presented in the previous paper[1b] that oil spreading did not greatly affect cleaning index value, for the fluorescent-dye, copper-galvanic-replacement, potassium ferricyanide-paper, and gravimetric tests. Thus, oil spreading effects must be considered only for the two wetting tests: the spray-pattern (waterbreak) and atomizer tests.

A search of the literature failed to locate sufficient quantitative information to permit the correction of the cleaning index values of the spray-pattern and

ered reliable

Absolute residual soil left by a given cleaner, as well as differences between cleaners, will depend on surface finish and other conditions selected for the laboratory test method. Significance of such results either on an absolute or relative basis must be determined by correlation with other types of laboratory tests and plant trials.

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Educational Committee Chairman Fred Fulforth emphasizes that a balanced program has been planned to cover both practical and academic aspects with special emphasis on "what's new".

A new electronic thickness gauge will be discussed by Abner Brenner. This is an instrument which should greatly simplify the ever important problem of determining plate thickness.

In the same vein, C. F. Waite of King-Seeley Corporation will outline the procedure, and will describe the equipment required, to determine the thickness of chromium plate by the anodic solution method. Of special interest is the fact that this method is accurate for determining chromium thickness over copper.

Quality control is of little value if frequency of testing is too low and is burdensome if tests are run too frequently. Ezra Blount of Products Finishing will outline methods to determine optimum testing schedules for both solution control and finished product inspection; an important tool in these days of increasing competition!

The nickel situation is forcing many platers to resort to protective organic coatings. Being a novice in this field the average plater has had to rely rather heavily on information furnished by the supplier. This has not proven one hundred per cent satisfactory. Answers to many of the problems encountered in organic finishing will be found in the information given in the paper, "Testing Procedure for Organic Finishers and Interpretation of Results", to be presented by Hutchinson of The Glidden Company.

In keeping with the "what's new" theme, bright gold plating will be discussed by Edwin Rinker of Sel-Rex Precious Metals, Inc.

Iron plating has been limited, to some extent, by the poor characteristics of the available plating baths. A newly developed alkaline iron plating bath appears to have overcome many of these difficulties. This bath is described in a paper by Foley, Linford and Meyer.

The symposium on chromium plating, outlined last month, will include a discussion on "A Corrosion Study of Chromium Electrodeposits" prepared by Brown and Hoover of the Udylite Corporation. This work is particularly interesting in that it discusses exposure tests of chromium plate on a variety of metals; a matter of strong interest in these days of substitute base plates.

The Program, A Preview

While a complete program is being prepared for the June issue of this journal, a preview of the doings for the big week is presented at this time.

Saturday, June 13, N.A.M.F. Board of Directors Meeting at 10:30 A. M. and the N.A.M.F. Annual Dinner Meeting at 7.30 P. M. in the Franklin Room.

Sunday, June 14, will be registration day at the Benjamin Franklin Hotel. Members will be able to sign in at the hotel and register for the convention in the leisure time of a Sunday afternoon.

Monday, June 15, will see the formal opening of the Meeting with a general welcome by Chairman Samuel Heiman to be followed by the opening address. Monday afternoon the technical program will be launched. All sessions will adhere to a schedule to permit an equal time distribution for presentation and discussion of each paper.

The International Fellowship Club will play host to the membership on Monday night with their annual Open House, a colorful affair known for good food and good fun.

On *Tuesday*, June 16, the morning technical session will be devoted to papers on cyanide decomposition and removal, plus a paper on the study of the effect of abrasive polishing on nickel. A new technique for plating on molybdenum will also be presented.

The morning session will be preceded by the annual Secretaries' Breakfast and by the Speakers' Breakfast.

The Golf Outing is being held at the Merion Country Club Tuesday afternoon. This club is unique in that there are two complete courses, one for low handicap players and one for "advanced beginners". A film, "Corrosion in Action", will be presented on Tuesday evening. This is also the traditional time for suppliers to hold open house.

Wednesday, June 17, there will be just one technical session, in the morning.

The Philadelphia Branch is understandably proud of the outing it has arranged for Wednesday afternoon. The "Delaware Belle" has been chartered for the exclusive use of the A. E. S. There will be a catered lunch with organized entertainment and unorganized loafing as the boat cruises along the Delaware River.

In the evening there will be an open question-and-answer session led by a panel made up of all of the speakers for the week. This promises to be a most active and enlightening session.

The Job Platers' Dinner, sponsored by the N.A.M.F., will be held in the Poor Richard Room at 7:30 P. M.

Thursday, June 18, the technical session will be turned over to the A. E. S. Research Committee for the presentation of a series of papers and a report on the current research program.

The social highlight of the Convention will be the Thursday night dinner and grand ball. An evening of food, fun, friends and fine entertainment.

It should be noted that plant visitations are scheduled for all four days of the Convention. The program is shaping up well and covers a wide variety of plants including job shops.

The 40th Annual Convention will truly be the standard of excellence for years to come.

CLEANING AND PREPARATION OF METALS FOR ELECTROPLATING

V. OIL SPREADING RATES*

project no. 12

project director:
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associate
EDW. B. SAUBESTRE*†

location:
COLUMBIA UNIVERSITY, NEW YORK CITY

Acknowledgment is due the Research Committee, Dr. W. A. Wesley, The International Nickel Company, Chairman; the Research Directing Committee, Mr. G. M. Cole, Fernstedt Division, General Motors Corporation, and Dr. Donald Price, Oakite Products, Inc., Chairman and Vice-Chairman, respectively; and the Project Committee, Mr. E. T. Candee, Lea Manufacturing Company, Chairman; Dr. W. A. LaLande, Jr., Pennsylvania Salt Manufacturing Company, and Dr. Edward Parker, Technic, Inc., for their contributions to this project.

*AUTHORS
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SUMMARY

The spreading rates of several oils on steel surfaces are determined. Oils which adsorb strongly to clean surfaces (e. g., oleic acid) spread least; non-adsorbing oils (e. g., mineral oil) spread rapidly. Fatty oils (e. g., lard oil) are intermediate in behavior. Spreading rates are higher on matte surfaces than on polished surfaces. Films of stearic acid render metal surfaces oleophobic; films of oleic acid render them oleophilic.

Cleaning index values obtained previously[10b] for the waterbreak and atomizer tests are corrected for oil spreading effects. The atomizer test remains the more sensitive one.

OBJECT

The object of this phase of the project is to determine the spreading rates of oils under conditions wherein the atomizer test may be used industrially, and to determine the effect of oil spreading on cleaning index values obtained with this test.

1. INTRODUCTION:

Purpose of Determining Oil Spreading Rates

The previous project publication, "Sequential Testing"[10a-i], compared the performance of various degreasing evaluation tests based on cleaning index values, in which the value of the cleaning index is a measure of the sensitivity of the test, the most sensitive test having the lowest cleaning index value. Initially, all the panels are soiled to a reproducible extent, but during the 30 minutes required to conduct sequential tests, the residual oil globules present on the surface tend to spread. This would therefore lead to lower cleaning index values for a given sample with the passage of time.

Evidence was presented in the previous paper[10a] that oil spreading did not greatly affect cleaning index value, for the fluorescent-dye, copper-galvanic-replacement, potassium ferricyanide-paper, and gravimetric tests. Thus, oil spreading effects must be considered only for the two wetting tests: the spray-pattern (waterbreak) and atomizer tests.

A search of the literature failed to locate sufficient quantitative information to permit the correction of the cleaning index values of the spray-pattern and atomizer tests for the effect of oil spreading. It was therefore necessary for the authors to perform a number of experiments in order to obtain such information. In order to study a number of typical conditions under which the atomizer test might be employed in industry, the spreading rates of various oils were determined for the conditions listed in Table I. See Appendix (b) for surface specifications of the steel used. Oleic acid was cp grade, free of linoleic acid. Stearic acid and tristearin were also cp grade. See a previous reference[10d] for specifications for lard and mineral oils.

2. EXPERIMENTAL

(a) *Procedure*

The sample is cleaned according to the method presented previously[10d], up to the benzene dip. After the benzene dip, the panel is slowly raised out of the solution and allowed to dry in air and then stored in a desiccator. When about to be used, the panel is rinsed twice in 10 ml portions of carbon tetrachloride, dried, and allowed to stand in air for several minutes. When a film of oil is to be applied to the panel before testing, the clean panel is dipped into a 0.1 per cent (by weight) solution of the oil in carbon tetrachloride,

*This manuscript is based on laboratory work done between February and June, 1951.

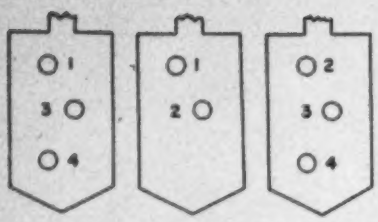


Fig. 1. Distribution of Oil Droplets on Test Panels

TABLE I. CONDITIONS FOR MEASURING OIL SPREADING RATES*

Surface†	Surface Condition	Oils Tested
matte finish polished finish	Clean Stearic acid film present Oleic acid film present Tristearin film present	Oleic acid Lard oil Mineral oil Various commercial oils

*All runs made at 26°–29° C (79°–84° F).
†SAE 1010 steel

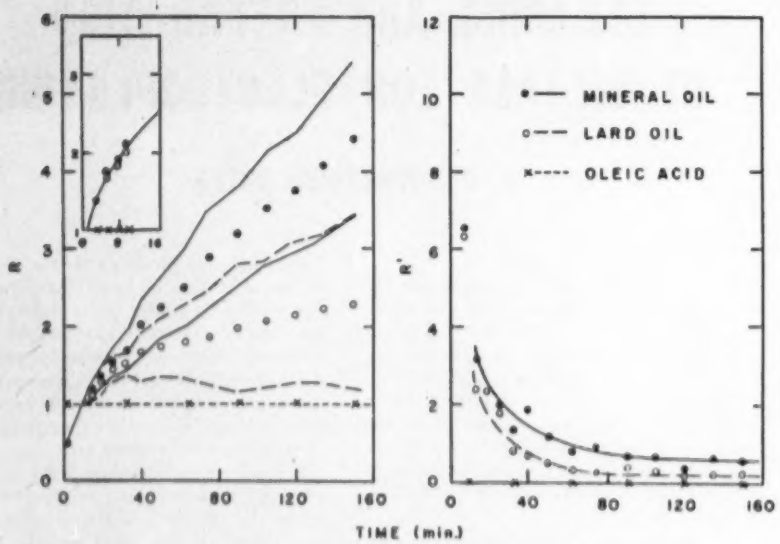


Fig. 2. Surface Finish: Matte; Surface Condition: Clean. $\bar{X}$ = L values (n = 4) given for mineral oil, lard oil, and oleic acid

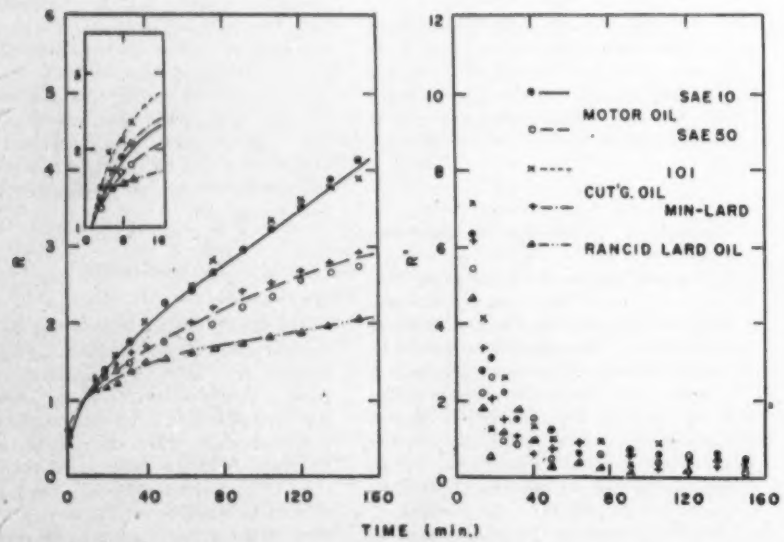


Fig. 3. Surface Finish: Matte; Surface Condition: Clean. $\bar{X}$ values (n = 2) given for various commercial oils

for 10 minutes. It is then removed slowly (2 minutes to remove a sample 3½ inches high) and dried in air.

Spreading rates are determined using three panels in such a fashion as to eliminate surface variation from panel to panel as a factor. A run consisting of 8 determinations, using duplicate drops of different oils, is designed as indicated in Fig. 1. A period of 10 minutes is allowed between applying each pair of drops.

The drops are applied either with a glass capillary or a platinum wire (statistical tests showed no significant differences in results obtained with the two methods). Readings are made of drop diameter at the following times after application of the drop: 1, 3, 5, 7, 9, 14, 19, 25, 32, 40, 50, 62, 75, 90, 105, 120, 135 and 150 minutes and, in a few cases, 24 hours. The diameter is measured by placing a screw caliper close to, but not touching, the drop. In most cases, the drops spread in circular fashion. In the few cases when this was not so, a representative diameter was chosen for recording purposes.

(b) *Recording of Results*

Bulkley and Snyder[97] were the first to present plots of the spreading of oil droplets as a function of time. They found it difficult to obtain reproducible results because of the fact that small errors in the initial determination of drop size could cause very large errors in R (R is the ratio of the *area* of the drop at any given time to its original area). Furthermore, any surface irregularities present at exactly the point of application of the drop could also cause large deviations in values of R with time. The authors have developed two plotting techniques which, at least in part, obviate some of these difficulties and make it easier to obtain reproducible results.

The total amount of spreading is presented as a plot of R_θ vs. θ, where θ is time and R_θ is the ratio of the area of the drop at any time θ, to its area 9 minutes after application of the drop. For comparison, plots are also given of R_1 vs. θ for the first 15 minutes, where R_1 has the area of the drop one minute after application as the standard of reference.

Fig. 4. Surface Finish: Matte; Surface Condition: Stearic acid film + 1 rinse in carbon tetrachloride (10 ml). $\bar{X}$ = L values (n = 4) given for mineral oil; $\bar{X}$ values (n = 2) given for lard oil and oleic acid

The differential rate of speading is presented as a plot of R′ vs. Θ. where

$$R' = \frac{R\theta_2 - R\theta_1}{R\theta_2} \times \frac{100}{(\Theta_2 - \Theta_1)},$$

and Θ_1 and Θ_2 are any two successive readings after Θ = 9 minutes. For comparison, an initial R′ value is also given, covering the period Θ = 1 to Θ = 9 minutes.

The diameter of the drops one minute after application ranged from 3 to 12 mm. Statistical tests showed that at Θ = 9 minutes, there was a significant correlation in many cases between R_1 and initial drop size, with the larger drops spreading more slowly. However, there was generally no such effect of initial drop size on values of R_θ after Θ = 9 minutes, as shown by statistical tests.

3. Results

(a) *Tabulated Results*

Because of the large number of experimental results obtained, it is necessary to present the more important results graphically only, as tabulations would be too lengthy. The results are given in Figs. 2–8, and Table II. No figures are given for conditions in which none of the oils spread, viz.:

Surface finish: Matte
Surface condition: Stearic Acid Film

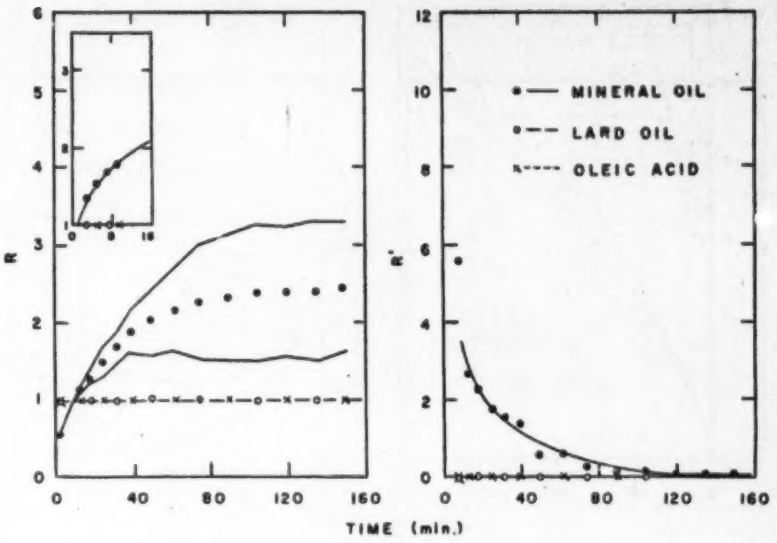
and

Surface finish: Polished
Surface condition: Stearic Acid Film (with or without CCl_4 rinses)

Many experimental points have been omitted from the graphs for the sake of clarity. The results obtained with tristearin films on the steel surfaces are not shown, but they are quite similar to those obtained with oleic acid films.

(b) *Correction of Cleaning Index Values*

Since the spray-pattern (water-break) test is conducted about one minute after the final pre-testing rinse, and the atomizer test about five minutes after this rinse, then, in comparing these tests one is interested in the spreading which takes place between Θ = 1 and 5 minutes, after leaving the final rinse bath, with a typical drop in the atomizer test spreading for about 2 minutes. Inspection of Figs. 2–8 will show that the maximum value of R for a two-minute spreading period in this time range is on the order of 1.5. That is, the area of the panel covered by oil globules increases about 50 per cent during the drying period involved in the atomizer test, at most. Strictly speaking, the



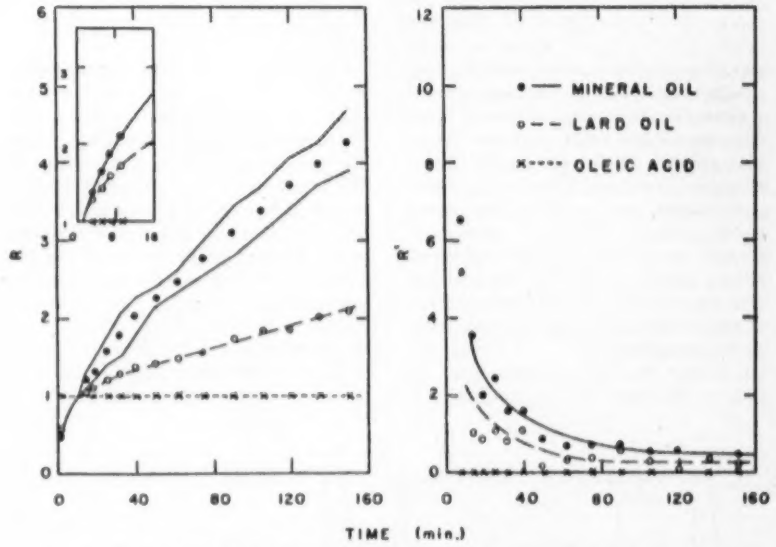


Fig. 5. Surface Finish: Matte; Surface Condition: Stearic acid film + several carbon tetrachloride rinses. $\bar{X}$ = L values (n = 4) given for mineral oil; $\bar{X}$ values (n = 2) given for lard oil and oleic acid

TABLE II. TWENTY-FOUR-HOUR SPREADING EXPERIMENTS

Surface Finish	Surface Condition	Oil Tested	No. of Runs	R_θ 9 min	60 min	150 min	24 hrs
Matte	Clean	Mineral	4	1.00	2.51	4.42	20.0
		Lard	4	1.00	1.82	2.52	9.6
		Oleic	2	1.00	1.00	1.00	1.03
Polished	Clean	Mineral	4	1.00	1.72	2.65	10.8
		Lard	4	1.00	1.29	1.44	1.60
		Oleic	2	1.00	1.00	1.00	1.00

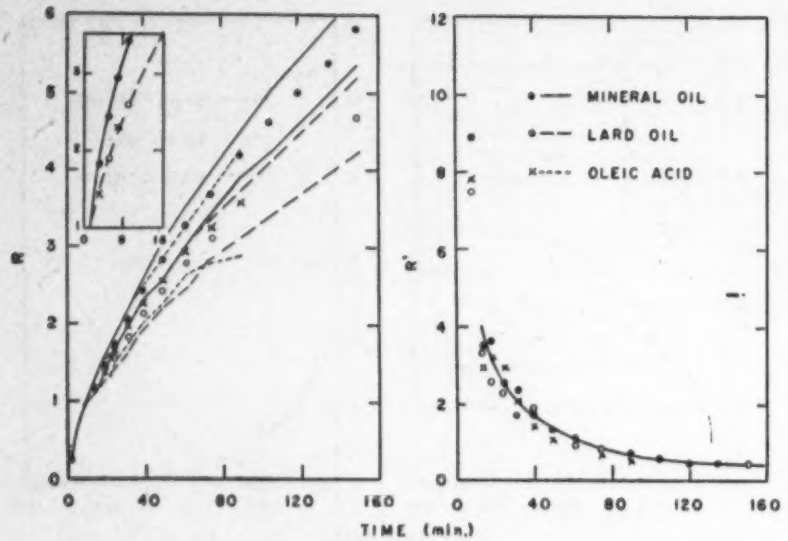


Fig. 6. Surface Finish: Matte; Surface Condition: Oleic acid film. $\bar{X}$ = L values (n = 4) given for mineral oil, lard oil, and oleic acid

spreading conditions which obtain during atomizer testing are not the same as those obtaining in the runs reported here. However, for reasons to be discussed below, only mineral oil globules spread during the course of sequential testing, and water preferentially wet a mineral oil-covered surface. Hence, globules of mineral oil present under water are quite spherical, with a high contact angle against the solid surface, much like the shape of the oil droplets applied to the dry surfaces in the tests reported here.

Referring to the sequential test results[10b], then one may correct the C.I. values listed for mineral oil by assuming that the oil coverage increased 50 per cent during atomizer testing (see Table III). It is seen that the atomizer test is still the more sensitive of the two, so that the effect of oil spreading alone cannot account for the differences in C.I. obtained with the two tests. This means that there are real differences in the nature of the two wetting tests, reasons for which have been previously presented[10f].

(c) *Discussion*

It can be seen from Figs. 2 and 7 that on clean surfaces, oleic acid is a non-spreading oil, lard oil a partial spreader, and mineral oil a rapidly spreading oil. A study of Fig. 3 will show that SAE 10 motor oil and 101 cutting oil are rapid spreaders quite similar in spreading properties to mineral oil. SAE 30 motor oil and mineral-lard cutting oil spread moderately and rather closely resemble lard oil. Rancid lard oil (artificially prepared in the laboratory by heating lard oil to 250° C (482° F) for 4 hours with admixture of air) behaves intermediately between lard oil and oleic acid.

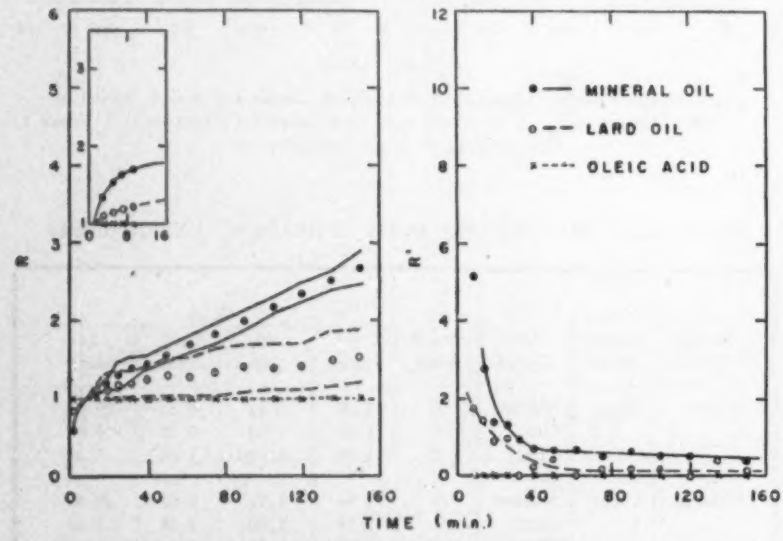


Fig. 7. Surface Finish: Polished; Surface Condition: Clean. $\bar{X}$ = L values (n = 4) given for mineral oil, lard oil, and oleic acid

When either matte or polished surfaces are covered with a thin film of stearic acid (see 2a, Experimental), none of the oils spread. Fig. 4 indicates what happens when a matte surface containing such a film is rinsed once with a 10 ml portion of carbon tetrachloride. It can be seen that oleic acid and lard oil still do not spread, but that mineral oil spreads slowly. When several carbon tetrachloride portions are used, as shown in Fig. 5, it is found that spreading conditions are about equivalent to those present on clean matte surfaces. On polished surfaces, rinsing in carbon tetrachloride does not cause spreading of any of the oils.

Figs. 6 and 8 illustrate the behavior of oils on surfaces coated with oleic acid films (surfaces coated with tristearin behave similarly). It will be noticed that all of the oils tested spread on such surfaces. It can also be seen that the differences between oils are considerably reduced, in particular, that oleic acid spreads as rapidly as lard oil (even more rapidly than lard oil on polished surfaces).

Comparing Figs. 2 with 7, and 6 with 8, it is seen that spreading of oils on polished surfaces is slower than on matte surfaces. The same relationship is found if the results presented in Figs. 4 and 5 are compared with the fact that, on polished surfaces, no spreading occurs with any of the oils tested when stearic acid films are present, no matter how many carbon tetrachloride rinses are applied.

Table II, which presents the results of 24-hour spreading runs, indicates that the general relationships developed for Θ = 150 minutes, also hold after 24 hours.

4. Theory

(a) *General Considerations*

In a previous publication[10f], equations were presented for spontaneous spreading of a liquid A on another liquid B (where the liquids are substantially insoluble in one another and evaporation is not a factor). It was stated there that spontaneous spreading will occur if the work of adhesion between the two liquids is greater than the work of cohesion of the liquids, i. e., where

$$W_a = \sigma_A + \sigma_B - \sigma_{AB} > W_c = 2\,\sigma_A$$

using equations developed by Dupré[26a] and Hardy[26b]. A quantitative measure of the spreading tendency can be obtained

TABLE III. TYPICAL CORRECTION OF ATOMIZER TEST C.I. VALUES FOR OIL SPREADING*

Test	Cleaning Index					
	Uncorrected			Corrected for Spreading		
	$\bar{X}$	σ	n	$\bar{X}$	σ	n
Spray-pattern (water-break)	95.6	2.7	12	—	—	—
Atomizer	41.0	7.4	12	60.7	5.1	12
Difference Between Tests	Uncorrected Atomizer vs. Spray-Pattern			Corrected Atomizer vs. Spray-Pattern		
$t_{obs.}$	23.9			20.9		
$t_{.05}$	2.07			2.07		
Difference Established	Yes			Yes		
$(\bar{X}_1 - \bar{X}_2) \pm L$	54.6 ± 4.7			34.9 ± 3.5		

*Mineral Oil Cleaned for 3 minutes at 40° C (104° F)[103b,t]

TABLE IV. SPREADING PRESSURES OF OIL ON STEEL[273]

Lubricating Oil, Oxidized in air at 200° C (392° F) for	Spreading Pressure on steel (dynes/cm²)	Spreading Pressure on water (dynes/cm²)
0 hrs	10.0	13.9
1	13.0	18.3
4	18.4	25.0
26	24.4	29.5

by considering the "spreading coefficient" (Harkins[267]) defined as:

$$\sigma_B - \sigma_A - \sigma_{AB} = W_a - W_c$$

which must be positive for spontaneous spreading to occur.

Harkins[267] gives the spreading coefficients (in dynes/cm) of some organics on water as follows [20° C (68° F)]:

Octyl alcohol	36.7
Undecylenic acid	32.0
Oleic acid	24.6
Benzene	8.9
Octane	0.2
Paraffin	−13.5

It will be noticed that the materials which spread greatly tend to be those possessing unsymmetrical molecular structure; that is, those with high dipole moments. Materials which spread little, or not at all, are those having little or no dipole moments. The fact that paraffin or mineral oil will not spread on water was first reported by Hardy[264]. When polar materials spread on water, a monomolecular adsorbed layer forms, with one pole of the molecule attracted to the water surface, and the other pole repelled by it. Spreading of such materials, according to Langmuir[268], Adams[254] and others, takes place by dragging out of the upper liquid by translational motion along the surface of the molecules of the lower liquid.

Turning ones attention now to liquids spreading on solids, Washburn and Anderson[273] measured the pressure against which oils will spread on polished steel. Their results are given in Table IV. The values increase with time since the content of polar material is increasing. It is seen that the results obtained on solid surfaces compare with those for water, so that we should expect that the oils which spread on water would spread on solids.

In the early 1920's, however, evidence began to mount, through the work of Hardy[264] and Woog[271], that just the reverse is true. It was found that mineral oils would spread rapidly on metal surfaces, while fatty acids hardly spread at all. Further confirmation is to be found in the more recent work of Bulkley and Snyder[257] and Cotton[266]. Some of the spreading results obtained by Bulkley and Snyder are shown in Fig. 9. Hardy's early theory[266] that this phenomenon was associated with vapor pressure effects seems to have lost favor because of subsequent experimental evidence. It must be recalled that translational motions of surface molecules of the liquid below is believed to be responsible for spreading on liquids. On solids, where the surface atoms are locked in place to a far greater degree, this spreading mechanism cannot be of importance. Volmer and Estermann[273], however, first demonstrated that surface migration can take place on solids, though to a comparatively small extent.

Let one consider, then, what happens when a material possessing a high dipole moment (i.e., one with greater affinity for adsorption on a metal surface) is placed on a metal surface. In the case of a fatty acid, such as oleic acid, the −COOH polar group will adsorb physically (at first) to the metal surface, and the $-CH_3$ polar group will orient itself in a direction away from the surface. If a

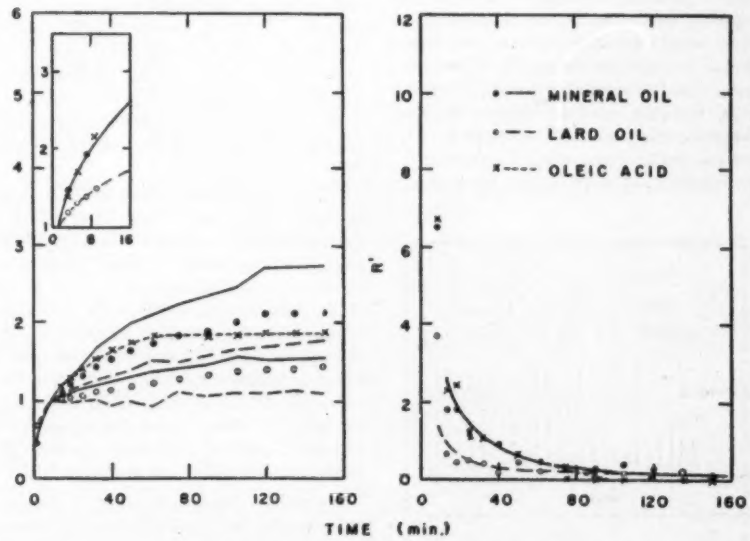


Fig. 8. Surface Finish: Polished; Surface Condition: Oleic acid film. $\bar{X} \pm L$ values ($n = 4$) given for mineral oil, lard oil, and oleic acid

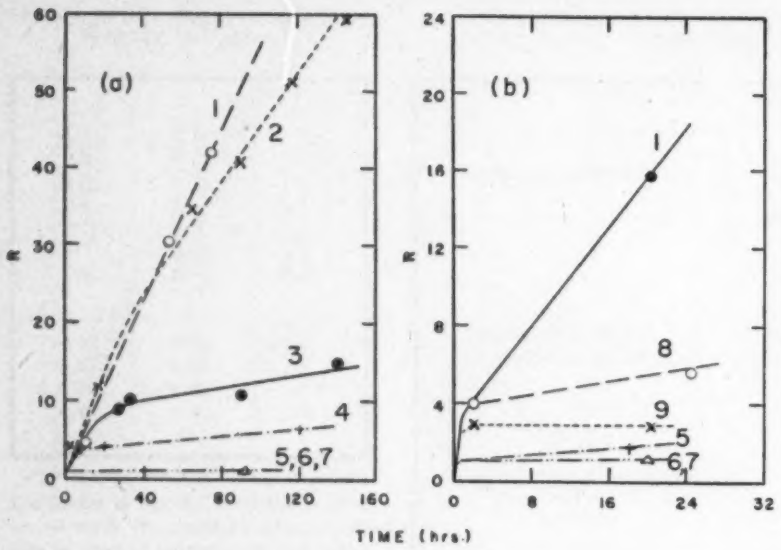


Fig. 9. Oil Spreading Rates (according to Bulkley and Snyder[257]): (a) Mirror-Polished Steel, (b) Polished Copper. 1. Turbine Oil, 2. Transformer Oil, 3. Medium Motor Oil, 4. Cylinder Stock, 5. Lard Oil, 6. Olive Oil, 7. Turbine Oil + 5 per cent Oleic Acid, 8. Porpoise Jaw Oil, 9. Sperm Oil

sufficient amount of active material is present, the adsorbed molecules will line themselves up side by side, with the $-CH_2-$ linkages standing fairly erect. As successive layers are built up, the orientation becomes increasingly random. The first few layers, however, which present $-CH_3$ groups to the surface, will repel the bulk of the oleic acid droplet which has $-COOH$ groups exposed. This model, as developed by Trillat and Fritz[271], is shown in Fig. 10. In other words, the bulk of the liquid floats on, and is repelled by, a very thin layer of adsorbed, oriented molecules of the same liquid. That oriented $-CH_3$ groups are oleophobic is also mentioned by Burdon[255]. Zisman and co-workers[256] have done much work recently on investigation of the oleophobic properties of oriented $-CH_3$ groups. Bulkley and Snyder[257] found that the spreading of mineral oil is stopped by prior application to the surface of a fatty acid, followed by a benzene rinse, which apparently removed the bulk of the oil, but did not remove the surface layer. Cotton[260] rendered the thin ring of adsorbed layers surrounding the bulk of the liquid drop visible by "breath figures" (i. e., a vapor condensation pattern).

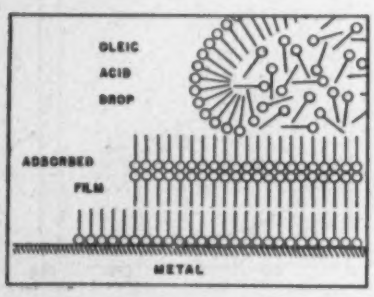


Fig. 10. Mechanism of Spreading of Oleic Acid (according to Trillat and Fritz[271])

On the other hand, when a material like mineral oil is placed on a solid surface, there are no polar forces active, and attraction to the surface is limited to Van der Waals and unsaturated metal surface forces, so that spreading takes place more readily. This was shown experimentally by Bulkley and Snyder[257]. Burwell[259] shows that the advancing contact angle of mineral oil on silver, copper, aluminum, SAE 1040 steel, 18/8 stainless steel and babbitt is 0°–7°, and the receding angle is 0°.

When very small amounts of polar compounds are added to mineral oil, the active material adsorbs selectively and readily to the metal surface. Thus, the mixture will spread slowly, if at all. Burwell[259] has determined the relative value of the work of adhesion for various oil mixtures (Table V), showing the great effect of adding small amounts of polar material to mineral oil. The lubricating oil listed in Table V probably consists of paraffinic material with small amounts of additives, some of which are polar.

Up to this point, only physical adsorption of material to solid surfaces has been considered. In many cases, in addition, chemical reaction takes place between the adsorbate and the substrate.

Using radioactive tracers, Bowden and Moore[264] found that stearic acid reacts chemically with zinc, cadmium, and copper surfaces, but not with gold or platinum surfaces. Octadecyl alcohol showed physical adsorption only. Ethyl stearate did not react with gold or platinum, but Sanders[270] using electron diffraction techniques found that with zinc, cadmium, and copper surfaces some reaction took place, probably arising from traces of stearic acid formed by hydrolysis. Dubrisay and Arlet[265] found that soluble corrosion products can accelerate spreading rates (see Table VI). Oleic acid attacks copper, but not nickel, so spreading occurs on copper surfaces, but not on nickel. With stearic or palmitic acids, no spreading occurs on copper surfaces because stearates and palmitates are less soluble than oleates. In the work reported here, corrosion effects were kept at a minimum by considering spreading effects for a 2½-hour time interval only. In the case of the few 24-hour experiments which were conducted, corrosion was visibly present for oleic acid, 101 cutting oil, and SAE 50 motor oil drops.

Surface roughness also plays an important role in the phenomena of spreading. Surface roughness, by increasing capillary action and by increasing hysteresis of the contact angle[103f], tends to increase surface spreading rates. As an example, a drop of lard oil was placed at the end of a long, straight scratch on a matte steel surface. After 90 minutes, R_3 was 3.82 measured in a direction parallel to the scratch, and 1.90 in a direction at right angles to it. After 135 minutes, the respective R_3 values were 4.41 and 2.21. Furthermore, any spreading phenomena which depend on orientation of adsorbed surface molecules will be disrupted if the surface is too rough to permit such orientation. Trillat and Fritz[271] not only found that surface roughness increases spreading rates, but that wetting is greater if scratch marks run in two perpendicular directions than if they are all in a parallel direction. The crystal structure of the surface may also be important. Morlock[269] claims that while non-polar materials spread on mechanically polished metal surfaces (which have an "amorphous" Beilby layer) and on glass (which is amorphous), such spreading can be prevented if the crystal structure of the metal is re-established (in the absence of capillary forces). Trillat and Fritz[271] found that if oxide films are very thin (no interference colors), the films are essentially amorphous and do not affect spreading rates. However, thicker oxide films (interference colors visible) seem to increase the spreading rates.

Studies of the spreading and adsorption of oils on metal surfaces have also been undertaken by those working in the field of boundary lubrication. Examples of reports of such studies are recent papers

by Burwell[259] and by Davey[261]. These authors stress some of the properties which a good boundary lubricant must possess: (1) a component of the boundary lubricant must have a high energy of adhesion. (2) the molecules of this component must be capable of forming a close-packed, relatively thick film. (3) the active component must be present in sufficient concentration to repair the surface film quickly enough to prevent prolonged metal-to-metal contact. (4) the adsorbed polar component should be capable of reacting chemically with the surface to form a film of low shear strength and simultaneously providing a physically adsorbed film to reduce friction. Both Burwell[259] and Davey[261], by studying frictional coefficients, came to the same conclusions as the authors cited earlier in this section regarding spreading and adsorption of oils, chemical reaction with metal surfaces, behavior of mineral oil containing small amounts of polar compounds, etc.

(b) *Correlation of Data with Theory*

In accord with the theory outlined above, the results of this investigation show that oleic acid does not spread appreciably on matte or polished, clean surfaces, while mineral oil spreads rapidly in approximately linear fashion. Oils consisting mainly of mixed fatty esters, such as lard oil, spread fairly rapidly initially, then slow down to a period of slow, but continuing spreading. Four commercial oils were also tested. It is seen that 101 cutting oil and SAE 10 motor oil may be characterized as being much like mineral oil, apparently containing little or no polar material, while SAE 50 motor oil and mineral-lard cutting oil are intermediate in spreading rate and so, must contain more surface-active material. The rates on polished surfaces are generally lower than on matte surfaces, which is again in accord with theory.

It will be noted that lard oil spreads moderately in these runs, yet in the cleaning experiments reported in Sequential Testing[102b] the residual lard oil droplets hardly spread at all, so that no correction in cleaning index value had to be made in Table III for runs made using lard oil. The cleaning runs were made at 70–100° C (158–212° F) in alkaline baths. Presumably, some hydrolysis occurred, increasing the original (<2 per cent) content of fatty acid in the oil. In addition, some iron soap may have been formed at the surface. Such adsorbed and chemically bound material would be harder to remove in the alkaline cleaner than the bulk of the oil. Thus, the residual oil droplets would undoubtedly be surrounded by rings of adsorbed, oriented material thus preventing spreading. That such was the case was shown by the fact that both atomizer and water-break tests showed the surface to be hydrophobic not only where visible droplets were located, but also for a distance around those droplets.

When a polished surface is covered with a thin film of stearic acid, one should expect oriented adsorption to occur, causing the surface to contain oleophobic $-CH_3$ groups. This is exactly what was found, for on such surfaces none of the oils tested spread. The case of matte surfaces, however, is highly interesting. If a thin film of stearic acid is applied to the surface, and the excess is washed away in benzene, the adsorbed film should lack any characteristic orientation owing to the extreme irregularity of the surface. It is found, indeed, that on such surfaces mineral oil spreads at the same rate (no statistically significant difference) as on clean surfaces. However, when no benzene rinse is applied, none of the oils spread. This is most remarkable, as the only explanation seems to be that the comparatively thicker film has an outer layer which is essentially regularly oriented, with oleophobic $-CH_3$ groups predominating. This effect was obtained many times without difficulty.

Based on the theory presented above, and on the observed facts that oleic acid does not spread on clean surfaces and that lard oil residues following alkaline cleaning do not spread, one should expect films of oleic acid to render surfaces oleophobic. Results show, however, that oils spread on such surfaces. In other words, surfaces of thin oleic acid films present a random orientation so that the surface is not oleophobic. Further, if rinsed in benzene or carbon tetrachloride, it was found that such surfaces are still not oleophobic. The reason for this behavior lies in the double-bond of the oleic acid molecule. When such molecules adsorb on surfaces *from a non-polar solvent*, the presence of the double-bond causes poor orientation and loose packing of the first, and, by consequence, of the succeeding layers. Thus, Zisman et al[256] were not able to get oleophobic monolayers from unsaturated acids dissolved in non-polar solvents. Prolonged contact of an oleic acid film deposited in this manner with excess oleic acid, however, may improve the orientation. Thus, in the authors' experiments on the spreading of oleic acid on polished surfaces covered with a solvent-deposited oleic acid film, the oleic acid spread rapidly for one hour (even more than mineral oil or lard oil). After 60 minutes, the spreading of the oleic acid droplet rather suddenly stopped, and the bulk of the oil began to gather together into several droplets. At 150 minutes, the total wetted area still had not changed, and the bulk of the oleic acid had shrunk into a few small droplets having a high contact angle with the surface.

On the other hand, the film deposited when oleic acid adsorbs on surfaces *in the presence of oleic acid only* appears to be better oriented from the start. This is indicated by the authors' results on the spreading of oleic acid, and by the observations of Bulkley and Snyder[257] and Cotton[260], who found that if a drop of oleic acid is allowed to roll slowly down a sur-

TABLE V. DIFFERENCE BETWEEN ADHESION ENERGY OF VARIOUS OILS AND THAT OF WATER FOR 18/8 STAINLESS STEEL[259]
($W_{oil} - W_{H_2O}$ in dynes/cm)

Mineral Oil	83.2	Mineral Oil + 1% cetyl alc.	1.1
Mineral Oil + 2% Oleic Acid	3.2	Oleic Acid	2.3
Mineral Oil + 2% Stearic Acid	3.1	SAE 30 Lubricating Oil (Penna. stock)	33.1

TABLE VI. SPREADING OF OILS WITH CHEMICAL REACTION[263]
Figures are diameters (cm)

Material	Time (days)	Pure	1% oleic	Paraffin Oil 10% oleic	1% stearic	1% palmitic
C*	0	0.675	0.50	1.2	0.85	0.60
C	2	0.75	0.80	1.45	0.85	0.60
C	7	0.80	1.50	3.0	0.85	0.60
N†	0	0.9	0.9	0.85		
N	21	1.05	0.9	0.9		
N	45	1.05	1.0	1.0		

*Polished Electrolytic Copper
†Polished Nickel

TABLE VII. ROUGHNESS OF POLISHED COLD-ROLLED STEEL

Specimen	RMS μ in	σ	n	t_{1-2}	t_{2-3}	t_{1-3}	$t_{0.05}$
1	0.67	0.10	5	0.40			2.31
2	0.74	0.38	5		0.86		2.31
3	0.57	0.24	5			0.87	2.31
Av	0.66	0.25	15				

face, the resulting surface is oleophobic to mineral oil.

Another interesting point may be noted in the oleic acid film experiments. It was shown above that if surface energy considerations alone prevailed, oleic acid would spread the most and mineral oil the least. However, oriented adsorption causes the reversing of this order. Now, on surfaces consisting of randomly oriented oleic acid molecules, oriented adsorption effects should be less important. It was, indeed, found that on such surfaces, oleic acid spreads very readily, even more so than mineral oil at times.

The atomizer test was used on clean surfaces to determine if there was any change of surface wettability in advance of the spreading oil drops. With mineral oil, it was found that the surfaces showed no change in wettability right up to the point where the advancing mineral oil drop was visible to the naked eye. With oleic acid, it was found that the drop appeared to be surrounded by a very small annulus of highly hydrophobic material. As the annulus was less than ¼ mm wide, however, no measurements were made on it.

5. Appendices

(a) *Laboratory Data and Statistical Analysis*

Space limitations do not permit the publishing of the laboratory data, nor of the statistical analysis of the results. However, the information contained in this entire series of Project 12 papers appears in substantially complete form (except for the Critical Review of the Literature, which is in a considerably shortened form) in the Ph.D. thesis of E. B. Saubestre, Columbia University, 1952. Anyone interested in the laboratory data, or in the statistical analysis may obtain the desired information in the near future through University Microfilms, Inc., Ann Arbor, Mich., or through the Columbia University Library.

The results which were discussed qualitatively in 3c above were analyzed statistically at the 0.05 level of significance using the criteria ($\bar{X}$, σ, t, L) which were explained in previous papers. With respect to the R_θ vs. θ curves of Figs. 2–8, the following curves were found to be significantly different:

Fig. 2—Mineral Oil vs. Lard Oil and Oleic Acid; Lard Oil vs. Oleic Acid. Fig. 6—Mineral Oil vs. Lard Oil and Oleic Acid. Fig. 7—Mineral Oil vs. Lard Oil and Oleic Acid; Lard Oil vs. Oleic Acid. Fig. 8—Mineral Oil vs. Lard Oil. Mineral Oil (Matte Surface)—Clean vs. Stearic Acid Film Surfaces, Stearic Acid Film + 1 carbon tetrachloride rinse Surfaces (after 1 hour) and Oleic Acid Film Surfaces; Mineral Oil (polished surface)—Clean vs. Stearic Acid Film Surfaces, with or without carbon tetrachloride rinses. Lard Oil (matte surface)—Clean vs. Stearic Acid Film Surfaces and Oleic Acid Film Surfaces. Mineral Oil (clean surface)—Matte vs. Polished Surfaces. Mineral Oil (oleic acid film surface)—Matte vs. Polished Surfaces. Lard Oil (clean surface)—Matte vs. Polished Surfaces (borderline case). Lard Oil (oleic acid film surface)—Matte vs. Polished Surfaces.

In the case of combinations of the curves presented in Figs. 2–8 which are not listed above, there is either no difference between the curves, or else the data are not sufficiently conclusive to establish a difference.

(b) *Polished Steel Specifications*

Specifications for matte steel samples were presented in an earlier publication[165d]. These surfaces were buffed to a high degree of polish through the kind services of Mr. E. T. Candee, of the Lea Manufacturing Company, to whom the authors are indebted. The surface roughness of the steel was determined with a Brush Surface Analyzer*. The results are given in Table VII. Readings were taken perpendicular to the direction of the buffing operation.

(c) *Nomenclature*

C.I.—Cleaning index = per cent of panel area which is "clean"

R—Ratio of drop areas at any two different times

R_1—Value of R referred to $\theta = 1$ minute as standard

R_9—Value of R referred to $\theta = 9$ minutes as standard

R′—Differential rate of spreading =

$$\frac{R\theta_2 - R\theta_1}{R\theta_2} \times \frac{100}{(\theta_2 - \theta_1)}$$

W—Work

σ—Surface tension

θ—Time

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Contribution No. 32 from the Chemical Engineering Laboratories, Engineering Center, Columbia University, New York, N. Y.

*The authors wish to express their appreciation to Dr. Louis Weisberg, 71 W. 45th Street, New York, whose generous assistance made possible the determination of the surface roughness of the polished steel.

Book Review

DR. HAROLD J. READ

Professor of Metallurgy, Pennsylvania State College

FINISHING MATERIALS AND METHODS by George A. SODERBERG, 1952, xi + 320 pages. McKnight and McKnight Publishing Company, Market and Center Streets, Bloomington, Ill. Price, $4.00.

The subject field of this book is limited to nonmetallic finishes such as varnishes, paints, lacquers, enamels, waxes and associated materials. Within this field, the author discusses the nature of the available materials as well as the equipment and techniques used in applying them. Although the volume was prepared primarily for use as a textbook, the treatment is eminently practical, for it was designed to be used in classes in vocational training. It is obvious, therefore, that the book offers but little to the man with wide experience in the field. For the prospective reader who desires a clear, concise, complete and elementary presentation of the subject, Mr. Soderberg's book can be recommended without reservation.

The first 135 pages are devoted to the nature, manufacture and uses of finishing materials. The discussions are semitechnical and, for example, do not require that the reader have an extensive background of training in chemistry. The most important part of this section is the attention which is given to the advantages and limitations of each material for specific types of applications.

Most of the remainder of the book is a presentation of practical techniques which can be used to produce specific finishes on wooden and metallic workpieces, although introductory chapters in this section are devoted to general techniques, such as brushing, spraying, roller coating, etc. In all, 26 typical finishing techniques, ranging from surface preparation to inlaying a gunstock with silver, are described in meticulous detail in a step-by-step fashion. The necessary tools and materials are also listed. It should be noted that emphasis in this entire section is not upon the problems of mass production; it is, rather, upon the individual operations which must be executed by the workmen and artisans.

Throughout the excellently printed and bound book there are many photographs and line drawings which are well integrated with the text and add a great deal to the clarity of presentation. Although they are not keyed to the text, many references to more detailed sources of information are given at the ends of chapters and after each "unit" in the section on finishing methods. For those who use the book as a text or for the reader who finds self-examination helpful, the questions which precede each group of reference citations may prove to be useful.

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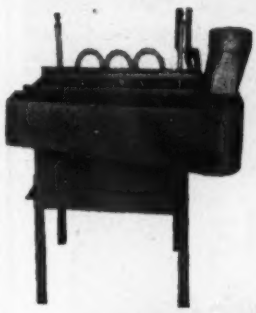

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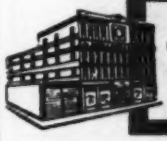

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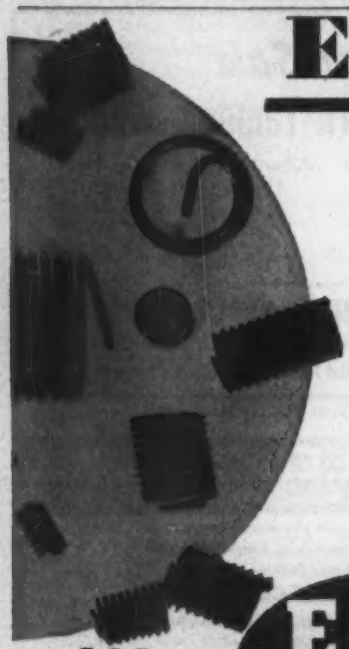

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readers' questions of general interest

Q. 156. The device hanging from the chain hoist is made of stainless steel and is used to scrape sugar cane pulp from large pressure rollers, and weighs approximately 800 pounds. The desire for applying a hard chromium plate over the face and around the teeth of it is necessary to prolong its life. We have built the special anode holder as shown in the photo. This holder is made of Plexiglas and is shaped to follow the contour and is covered with 6 pound sheet lead the full width and length of the returner-bar, including a small strip behind the bar as shown by the arrow. Four lead-ins to the anode are of 6 pound sheet lead, 4 inches wide. We have had three failures on this job using two rectifiers; in other words 3,000 amperes, and get plate no place except on the tips of the teeth. Will you be kind enough to offer a suggestion which would solve our problem?

A. First, it is a borderline case on current and it is not evident that they are masking and insulating the important sections such as ends, top and bottom. They should be using copper to bring in the anode current instead of sheet lead. The backs of the teeth should be lacquered off, and if they don't plate, a conforming anode in the teeth may have to be used and the job done in two operations. The large flat anode should also be closer. The face of the part should have a good polishing before plating. If they can't cover it this way, they can always plate half at a time; concentrate the 3,000 amps. on half, then move over the anode to the other half and finish the job. They should also consult their guidebook on how to treat the stainless. —Arthur W. Logozzo.

Q. 157. In silverplating heavy bronze contact knives (0.002–0.0025 inch of silver on the contact surface) for all kinds of electric switches for power stations, etc., one of the disadvantages is that the deposit is too soft and consequently the wear resistance is too small and life too short. On the other hand silver is the most suitable deposit, because of its electrical conductivity. Do you think that rhodium plating on the silver deposit would be practical and economical and, of course, give the desired results?

A. Problems similar to those outlined in the question above have been solved for General Electric and Westinghouse, by the use of 1/32 inch thick silver plates soldered to the contacts, or by fabricating the part from copper stock containing an overlay of silver. Experience with rhodium plating silver contacts to handle such loads as 2,000 amperes is very limited.—H. Robinson.

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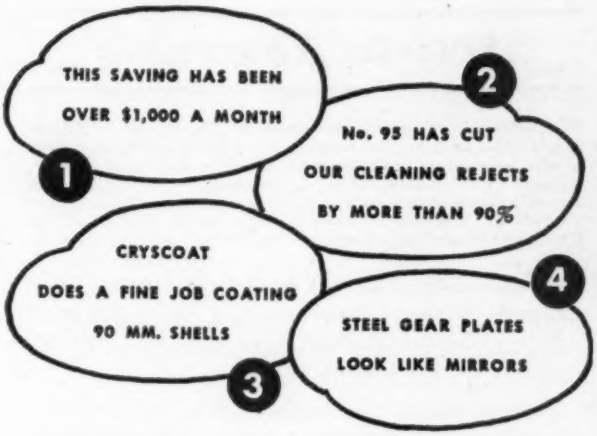

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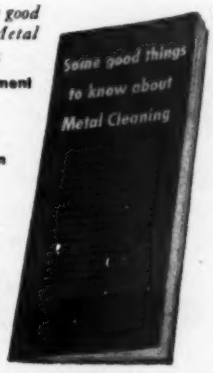

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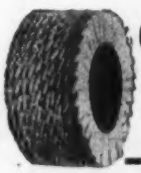

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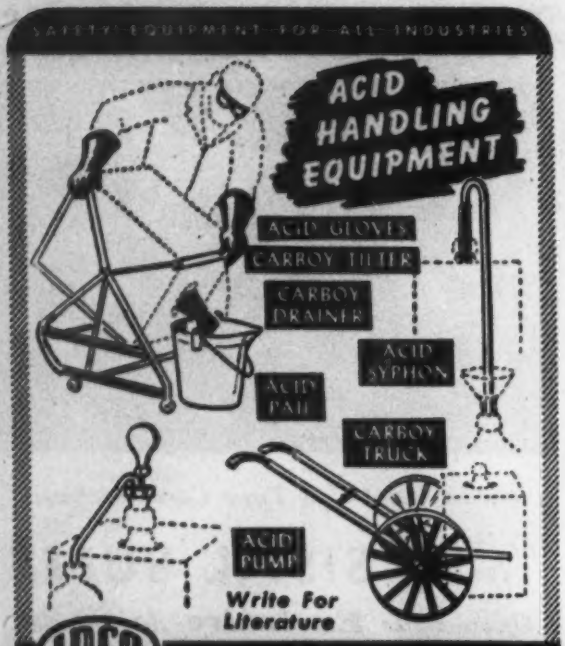

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Article Abstracts

No copies of articles are available at the offices of "Plating". Photostats may be had from libraries having files of the journal in question and offering photostat service, usually at 30-50 cents a page. Ask your public library to consult the Union List for names of libraries having the particular journal. Abbreviations used are those of Chemical Abstracts.

Electrodeposition of Tin-Nickel Alloy Plate from Chloride-Fluoride Electrolytes. J. W. Cuthbertson and N. Parkinson and H. P. Rooksby. J. Electrochem. Soc. **100**, 107–119 (March, 1953).

Tin and nickel can be codeposited in approximately equi-atomic proportions from solutions containing stannous chloride, nickel chloride, and fluorides. The alloy deposits thus obtained are almost fully bright and are single phase, having a nickel arsenide type of structure.

In the absence of fluorides, satisfactory alloy deposition is not possible from chloride solutions. Evidence is adduced that the fluorine complexes both the tin ions and the nickel ions.

The conductivity and throwing power of the electrolyte have been determined. The X-ray structure of tin-nickel alloy deposits covering a range of composition has been examined, and it is shown that bright deposits are characterized by a preferred orientation of the crystallites.

From solutions of this type, tin-nickel alloys can only be obtained by operating at a temperature above 45° C, the optimum temperature being 65° C.

Tin-nickel alloy deposits as normally obtained contain approximately 65 per cent of tin and 35 per cent of nickel. Such deposits have a pleasing color, showing evidence of a faint rose-pink tint, and are equally as resistant, or even more resistant, than electrodeposited chromium to atmospheric tarnishing. The progress made to date in the industrial development of the tin-nickel alloy plating process is briefly reviewed.

Plating on Aluminum. Steel **132**, pp. 76–78, (February 16, 1953).

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Zincate immersion pretreatment is the most practical and economical method for plating on aluminum. Recent studies conducted by W. G. Zelley at Aluminum Research Laboratories show how to smooth-out production line difficulties and improve corrosion resistance of plated products.

Electrodeposition Behavior of Cadmium and of Thallium at Mercury Cathodes. L. B. Rogers and Charles Merritt, Jr., J. Electrochem. Soc. **100,** 131–135 (March, 1953).

The deposition behavior from approximately millimolar solutions of thallium (I) and cadmium at a mercury cathode can be predicted from polargraphic data within 10 mv. The variations in the deposition at a particular potential were usually smaller than that corresponding to ±5mv when using instruments with control limits of about ±3mv. The presence of about 0.02 *F* copper or bismuth in the mercury appeared to have no effect on the deposition behavior of cadmium. During the course of this study, several incidental observations of practical importance were noted.

The Anodic Oxidation of Aluminum. G. C. Thompson. Electronic Eng. **24,** pp. 281–283 (1952). Met. Abstrs. **20,** p. 353 (January, 1953).

The theory of anodizing is discussed, and details of the chromic-acid process (Bengough-Stuart process) and the sulfuric-acid process are given. The chromic-acid process is unsuitable for use with aluminum alloys containing > 5 per cent copper, but the corrosion-resistance of the film produced by it is better than that produced by the sulfuric-acid process. The sulfuric-acid oxide film is transparent, whereas the chromic-acid film is not. Notes are given on the final treatment, multichrome dyeing, and a method of removing patchy and streaky films before re-anodizing.

Electrical Measurement of Corrosion Rate. N. B.S. Summary Technical Report 1734 (December, 1952).

A recent laboratory study by the National Bureau of Standards proves for the first time that the rate of

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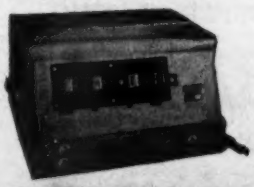

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weight loss of a piece of steel corroding normally in soil can be measured electrically, without actually weighing the metal. Conducted by W. J. Schwerdtfeger and O. N. McDorman of the N. B. S. corrosion laboratory, the study gives further evidence that the electrochemical theory of corrosion applies generally to soils. Although the N. B. S. measurements were restricted to the laboratory, the success of the work suggests the possibility of valuable practical applications, such as determination of the corrosion rate of a tank or other underground structure without the need for visual inspection.

Tin Plating of Silicon-Containing Aluminum Alloy. Tokichi Izumi. Japanese Patent No. 2820 ('50) (September 22). C. A. **46,** 10021 (November 10, 1952).

Loex alloy containing silicon 10–13, copper 1.5, magnesium 0.5 per cent, and the rest aluminum is immersed two minutes at 70° in a solution containing NaOH 0.2, Na_2CO_3 and Na_3PO_4 1 per cent, then electrolyzed 2–5 seconds in a solution containing NaOH 0.1 and Na_3PO_4 5 per cent by alternating current at 24 volts and 40–50 amperes per square decimeter to remove all adhering fatty material, washed 5 minutes at room temperature in a solution containing HNO_3 (density 1.42) and 30 per cent HF (ratio 1:3), then tin plated by immersing 3–5 minutes at 80° in 5 per cent Na_4SnO_4.

Electro-Spark Erosion. Metal Ind. (London) **81,** 31–33 (July 11, 1952).

The introduction of the "Sparcatron" process, a novel method of machining metals and metal carbides by electric spark discharge may well mark the advent of a new era in the application both of intrinsically hard and hardened metals and metal carbides. The process allows these materials to be machined conveniently and economically, and shows its greatest economy when complex shapes are involved.

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Chromium-Plated Aluminum. Canad. Metals **14** (9), p. 48 (1951). Met. Abstrs. **20,** p. 182 (November, 1952).

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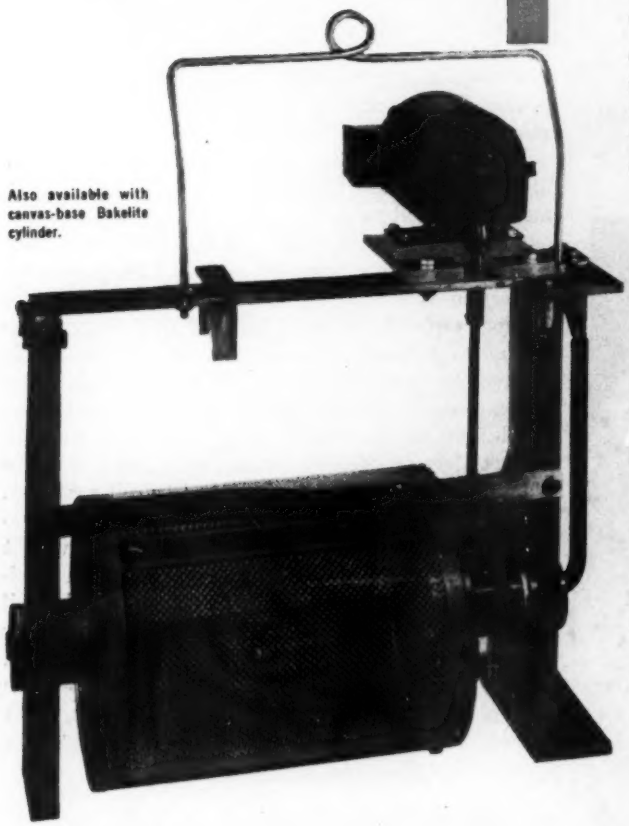

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Article Abstracts

until the aluminum is immersed in the plating bath. The abrasive coating is then washed away, and it settles to the bottom of the bath.

Corrosion of Galvanized Steel in Soils. Irving A. Denison and Melvin Romanoff. J. Research N. B. S. 49, 299 (November, 1952). (N. B. S. Research Paper 2366; 10 cents from Superintendent of Documents, Government Printing Office, Washington 25, D. C.)

A study of underground corrosion of hot-dipped galvanized steel pipe has recently been completed by the National Bureau of Standards. Results confirm previous N. B. S. work in showing that galvanized steel having 3 ounces of zinc per square foot of exposed surface is highly resistant to corrosion in many soils which are very corrosive to bare steel. Conducted by Irving A. Denison and Melvin Romanoff of the Bureau's corrosion laboratory, the present study was an outgrowth of earlier N. B. S. exposure tests of zinc coatings for underground use.

For the Bureau's study, short lengths of both galvanized and uncoated steel pipe, and also plates of zinc, were buried at 15 test sites for periods up to 13 years. Located in widely separated parts of the United States, the test sites represented a wide range of soil properties.

An interesting finding of the N. B. S. study was the high corrosion resistance that the galvanized specimens continued to show in most of the soils after the outer zinc coating, and even after the zinc-iron alloy layer, had entirely corroded away. This continuing protection is tentatively attributed to an inorganic coating, probably silicious, believed to have been deposited by galvanic action between the outer zinc coating and the underlying steel or alloy layer. This tentative explanation is based in part on unpublished studies which indicate that the zinc-iron alloy layer does not protect steel sacrificially (cathodically), and that the alloy is no more resistant than steel to soil corrosion. Analysis of the data obtained in the course of the two N. B. S. field studies shows that the minimum weight of zinc coating required to protect steel for a minimum of 10 years depends on the nature of the soil environment. In the N. B. S. studies a 2-ounce coating gave sufficient protection in inorganic oxidizing soils, but for inorganic moderately reducing soils a 3-ounce coating was required. Highly reducing soils, both organic and inorganic, require coatings heavier than 3 ounces per square foot.

Electrolytic Polishing of Aluminum. Shin-ichi Tokumoto, et al. (to Scientific Res. Inst., Ltd.) Japanese Patent 855 ('51), February 23. C. A. 46, 10978 (November 25, 1952).

Aluminum is polished by electrolysis with alternating current in an electrolyte containing H_3PO_4, $H_4P_2O_7$, and HPO_3, a substance which has no direct dissolving action on the metal, for example, $C_3H_5(OH)_3$.

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Patent Abstracts

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No. 2,624,728, January 6, 1953—Electroplating Barrel —George Dubpernell and Stephen M. Marten, assignors to United Chromium Incorporated.

CLAIM. In an electroplating barrel for barrel plating articles with chromium or with other metals difficult to electroplate comprising a tank for holding a plating bath, a rotatable open-ended article-supporting metallic cylinder supported on the tank for partial immersion in the bath, a horizontal conducting shaft electrically and structurally connected at one end of the cylinder by means of which the cylinder is rotated, means for electrically connecting the shaft to the cylinder, an anode supported in the cylinder, means for rotating said cylinder shaft and the cylinder connected thereto, and means for connecting said cylinder and the anode in an electric circuit through the plating bath, the improvement in which said cylinder is imperforate, said cylinder having a conducting inner cylindrical surface and having electrical insulation covering the outer cylindrical surface thereof to avoid diversion of current between the anode and the articles supported in said cylinder, said electrical connecting means between the cylinder and its supporting shaft comprising a split tapered threaded hub attached to the cylinder for receiving the shaft, and a nut for said threaded hub acting to force the split end of the hub into binding engagement and firm electrical contact with the shaft, said hub and nut also permitting the cylinder to be detached from the shaft, said means for rotating the cylinder and cylinder shaft comprising a conducting pulley on the cylinder shaft and a non-conducting driven belt for driving said pulley, and said means for connecting the cylinder and anode in an electrical circuit including contact brushes in contact with said conducting pulley.

1 claim, 14 figures.

References cited: U. S. Patents 703,623; 901,280; 1,185,946; 1,609,357; 1,789,443; 1,835,643; 1,899,679; 2,133,324; British Patent 23,267.

No. 2,626,895, January 27, 1953—Electrolytic Production of Iron—Clarence W. Blake, assignor to Fansteel Metallurgical Corporation, North Chicago, Ill.

CLAIM 1. The method of producing electrolytic iron for powder metallurgy purposes which comprises forming an aqueous bath containing ferrous chloride, ammonium sulfate and ferrous sulfate in the ratio by weight from about 1:7:9 to about 1:23:32, electrodepositing the iron onto a cathode formed of a metal

selected from the group consisting of columbium, tantalum, molybdenum and tungsten, removing the deposited iron from the cathode and reducing the iron to powder form, the aqueous bath containing, in solution, from about 25 grams to about 40 grams of iron per liter and a sufficient amount of acid to maintain the *p*H slightly below the hydrogen ion concentration at which the ferric hydroxide is precipitated.

4 claims.

References cited: U. S. Patents 1,416,692; 1,860,505; 2,157,699; 2,229,077; 2,287,082; 2,464,168. Transactions, Electrochemical Society, Vol. 25 (1914), pp. 529–536.

No. 2,627,145, February 3, 1953—Conformable Abrasive-Coated Sheet Material—R. S. Frigsted, Assignor to Minnesota Mineral and Mining Company.

A waterproof, flexible abrasive sheet material of high initial flexibility and high efficiency in the presence of water, having a degree of stretch at break in any direction equivalent and capable of conforming to irregular surfaces by substantial universal stretching under tension both in dry state and after prolonged immersion in water; said sheet comprising: a multi-laterally stretchable fibrous base sheet characterized by a plurality of crossing sets of creping crinkles, a resinous impregnating and stretching agent for said sheet comprising a thermo-plastic film-forming waterproof synthetic resin; a resinous binder coat; and a layer of abrasive grits embedded in said binder coat.

3 claims.

No. 2,628,925, February 24, 1953—Bright Corrosion Resistant Coating of Metals—Charles W. Ostrander, assignor to Rheem Manufacturing Company.

CLAIM 1. An aqueous acidic solution for treating metals selected from the group consisting of zinc or cadmium and alloys thereof to impart a bright colorless surface to the metal consisting essentially of chromic acid, 10 grams per liter, and 320 grams per liter sulfuric acid and acetic acid. The chromic acid and sulfuric acid being present in the ratio of about 1 cc per liter of sulfuric acid to about 16 grams per liter of chromic acid, the acetic acid being present in amount of about 25 to 200 cc per liter.

7 claims.

No. 2,628,936, February 17, 1953—Method of Forming a Point at the End of a Wire—V. J. Albano, Assignor to Bell Telephone Laboratories.

CLAIM 6. The method of pointing a phosphor bronze electrical contact wire by electrolytic etching which comprises mounting the wire with a portion thereof external of an electrolytic solution of phosphoric acid and one end thereof extending through the surface of and into the electrolytic solution, floating a layer of light mineral oil which is non-conductive, and immiscible and chemically inert to the electrolytic solution, the degree of adhesion of the light mineral oil to the

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1— 2500 A. Chandey. 6/12 V.	1— 500 A. G. E. 28 V.
1— 1500 A. HVW 6/12 V.	1— 800 A. G. E. 28 V.
1— 800 A. HVW 6/12 V.	1—1500 A. Cent. 28 V.
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1— 200 A. Belmin 6 V.	1— 200 A. West. 32 V.
1— 200 A. U. S. 12 V.	1—1000 A. Cent. 32 V.
1— 150 A. HVW 6 V.	1—1000 A. Chandey. 40 V.
3— 125 A. Hobart 6 V.	1—1250 A. Cent. 45 V.
1— 120 A. Eager 7½/15 V.	1— 75 A. G. E. 50 V.
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wire determining the shape of the meniscus in the electrolytic solution around the wire at its point of penetration into the electrolytic solution and determining the rate of etching in the electrolytic solution immediately below the interface between the electrolytic solution and the light mineral oil, and passing current through the wire connected as an anode, the electrolytic solution to partially etch that portion of the wire in the electrolytic solution immediately below the interface.

Legend. . . . an electrolytic etchant comprising 250 grams per liter of phosphoric acid and having a 3 to 4 millimeter layer of mineral oil on its surface, by applying a 3.5 volt potential until the current decreased to a minimum of 80 milliamperes.

Successful points have been made with various grades of mineral oil, kerosene, a liquid silicone, hexane, benzol, xylene and cyclohexane and various mixtures of these liquids.

6 claims, 6 figures.

References cited: U. S. Patents 2,115,005; 2,434,286. The Physics of Chemistry of Surfaces, by Adams, 3rd edition (1941), pp. 188, 189, Oxford University Press.

No. 2,629,212—February 24, 1953—Buffing Wheel and Making of Same—George Albert Lyon.

CLAIM 1. A surface-treating assembly comprising a first core section having an axial aperture therethrough and an axially extending upwardly inclined surface that has the highest point adjacent one end face of said first core section, and an elongated strip of surface-treating material, means for securing one end of said material to said first core section at a point spaced from said one end face, a second core section having an axial aperture arranged to be aligned with the aperture of said first section on a common spindle, said second core section having an axially extending upwardly inclined surface with the highest point adjacent the end face of the second core section that abuts said one end face of said first core section, means for securing the other end of said strip on said second section adjacent the low end of said surface.

6 claims, 1 figure.

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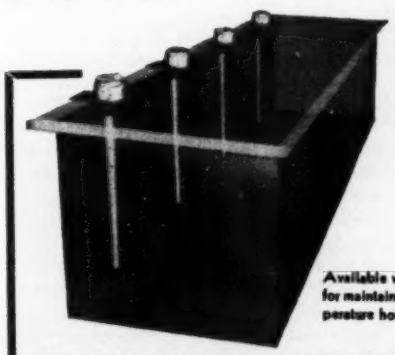

Available with brass sheath for maintaining constant temperature hot water supply

CHECK THE ADVANTAGES CLEPCO-GLOROD IMMERSION HEATERS OFFER YOU: Heavily constructed steel units available from stock immediate delivery • Quartz inner element conducts heat uniformly and efficiently • Nickel alloy resistance wire develops rapid temperature rise • Low heat-density prevents carbonization • Vapor-proof junction box prevents entrance of vapors or liquids • Temperature can be thermostatically controlled • Can be supplied with brass or stainless steel external sheaths • Portable, may be moved from tank to tank • Sturdily constructed for lifetime performance • Recommended and sold by leading electro chemical supply houses.

Write for Bulletin WMF

CLEVELAND PROCESS COMPANY

7016 Euclid Ave., Cleveland 3, Ohio

CUT COSTS IMPROVE RESULTS ELIMINATE CLEANING PROBLEM

DIVERSEY NO. 909

DIVERSEY NO. 12

Diversey No. 909 and No. 12 are two outstanding cleaners specially developed to provide superior finishes on steel surfaces through better, more thorough cleaning performance.

No. 909 and No. 12 are easily applied to a variety of different cleaning routines. No. 909 is a unique heavy duty soak tank cleaner. No. 12 is an electrocleaner for both direct and reverse current. The following case history is typical of the results you can expect through the application of Diversey No. 909 and No. 12.

CASE HISTORY

RADIO CHASSIS

PROBLEM:

To remove stamping oils and shop dirt from radio chassis in a conveyorized sequence of operations which was arranged for vapor degreasing and electrocleaning.

Former Process: Prior to a cyanide copper strike, the chassis were cleaned in a vapor degreaser, a 10-12 ounce per gallon electrocleaner, a 50% muriatic acid pickle and appropriate rinses.

Present Process: Includes a 3-minute immersion in 6 ounces Diversey No. 909 per gallon, a 1-minute reverse current electroclean in a 10 ounce per gallon solution of Diversey No. 12, a rinse, a 50% muriatic acid pickle, a rinse and a copper strike.

Results: At the time this problem was presented to the D-Man, the firm having the job was ready to cancel it. Their process was incapable of producing a sufficiently clean surface for acceptable adherence of the electro-deposit. The first step toward a solution of this problem was to replace the electrocleaner with Diversey No. 12—*and this solved the problem!* Diversey No. 12 removed all contaminant residues remaining after the degreasing operation and produced a surface to which, when pickled, electrodeposits adhered perfectly. Diversey No. 909 replaced the vapor degreaser because of its ability to remove even solid particle contamination and its capacity for contamination. The soak tank and the electrocleaner are of 2400 and 2000 gallons respectively, yet only 250 pounds Diversey No. 909 and 150 pounds Diversey No. 12 are added weekly for upkeep in this high production line!

complete information available

Write today for additional information, including technical bulletins, or call your Diversey D-Man.

THE DIVERSEY CORPORATION

Metal Industries Department

1820 Roscoe Street, Chicago 13, Illinois

IN CANADA: The Diversey Corporation (Canada) Ltd., Lakeshore Road, Port Credit, Ontario

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The job-shop management to whom this publication is directed represents the viewpoint of the economic operation of our industry. The technical view is equally as important to the goals you hope to reach. Cooperation with and support of the representatives of this part of the metal finishing industry can bring about the long steps toward a mutually hoped-for purpose.

The program being carried out by the American Electroplaters' Society is producing benefits directly for the job-shop operator as well as for the manufacturer who finishes his own work. Yet, it is the manufacturer, in many instances, who supports this activity with sustaining memberships in the Society. True, many shops have taken such memberships, but many more could profitably do so. By backing this organization to the hilt, and by seeing to it that your technical men take advantage of the educational opportunity available at Branch meetings—you will assure the technical success of your operation, as you assure the success of your management functions by participating in the Federation and your local associations.

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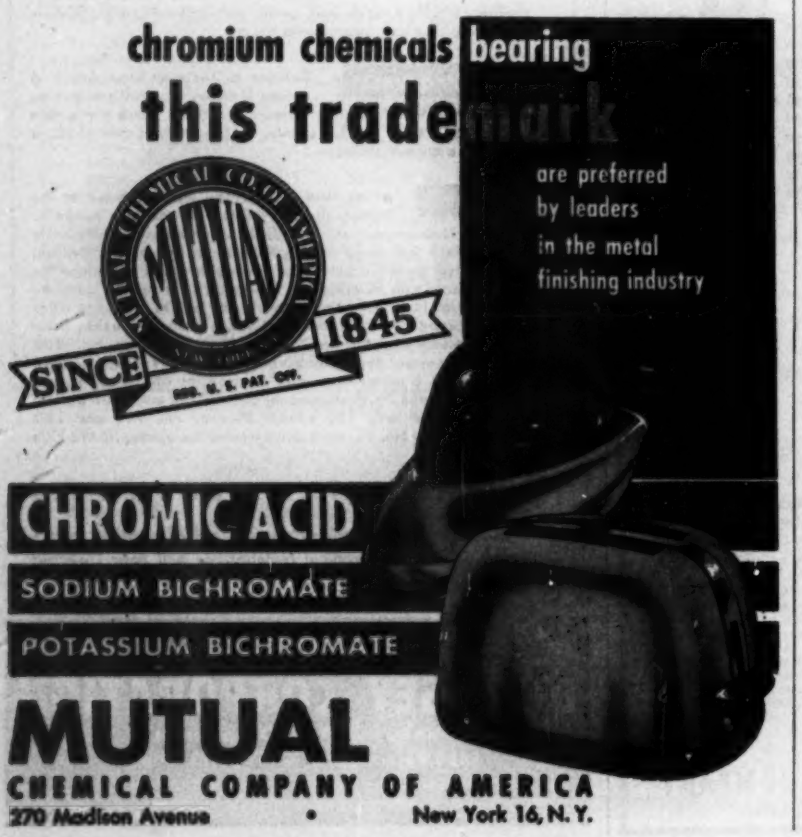
Balance your own efforts, and take equal care of your technical development and the improvement of your management ability.



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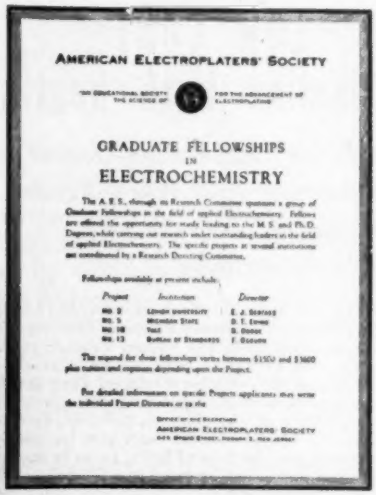
The Research Committee requested that this be brought to the attention of all A. E. S. members in order that they might pass on this information to their sons and daughters in college.

Those desiring further information can write to Dr. E. J. Serfass at Lehigh University or the Executive Secretary, Newark, N. J.



AMERICAN ELECTROPLATERS' SOCIETY

GRADUATE FELLOWSHIPS
IN
ELECTROCHEMISTRY

The A. E. S., through its Research Committee sponsors a group of Graduate Fellowships in the field of applied Electrochemistry. Fellows are offered the opportunity for study leading to the M. S. and Ph. D. Degrees, while carrying out research under outstanding leaders in the field of applied Electrochemistry. The specific projects at several institutions are coordinated by a Research Directing Committee.

Fellowships available at present include:

Project	Institution	Director
No. 2	Lehigh University	E. J. Serfass
No. 5	Michigan State	D. T. Ewing
No. 10	Yale	R. Glang
No. 13	Bureau of Standards	F. Blum

The stipend for these fellowships varies between $1500 and $1600 plus tuition and expenses depending upon the Project.

For detailed information on specific Projects applicants may write the individual Project Directors or to the

Office of the Secretary
AMERICAN ELECTROPLATERS' SOCIETY
445 Broad Street, Newark 2, New Jersey

Library Acquisition

In response to a request that the membership help us build up a Headquarters' Library, Honorary Member, William Phillips, has graciously donated over forty volumes of A. S. T. M. **Proceedings** and Standards dating back to 1926. The contribution constitutes a substantial proportion of the A. E. S. Library at present, but it is hoped that eventually a complete file of the **Proceedings** and the Monthly and Quarterly Review will be available at Headquarters along with all books dealing with electrodeposition and allied arts.

Sustaining Members

The following organization has joined the ranks of sustaining members whose dues go to support of A. E. S. Research: Palumbo Brothers, Inc., Newark, N. J.

With this newest addition, the total number of sustaining memberships is now 344, representing 306 different organizations.

LEA Copper Glo

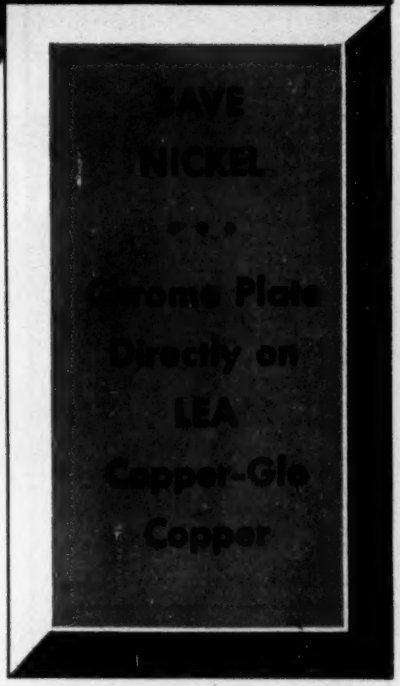
TOPS in Brightness plus Throwing Power and Plating Speed

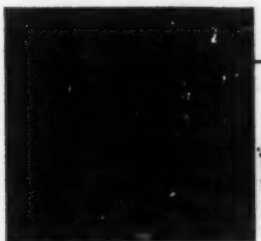
are interested in [illegible] existing equipment. If your problem is one of obtaining a bright, soft copper with a minimum of tank tie-up time, LEA Copper Glo can solve this in a way you cannot afford to overlook.

LEA Copper Glo gives you brilliance with exceptional speed of deposition and excellent throwing power. Its high speed plating characteristics (Hull cell bright current density range 10-60 amperes/sq. ft. for standard formulations) permits production increases of from 30% to 60%, using existing equipment.

Plating minutes are valuable to you. Check up on Lea Copper Glo by the Ronal Process. In addition to brightness and high current density operation, it offers such added operating advantages as greater throwing power, ductile deposits, elimination of wetting agents and low copper concentrations.

* *The Ronal Bright Copper Process is a development of Ronal Chemicals Inc., Brooklyn, N. Y., for which process patents are pending.*





THE LEA MANUFACTURING CO.
16 Cherry Avenue, Waterbury 20, Conn.
LEA MFG. COMPANY OF CANADA, LTD.
370 Victoria Street, Toronto 2, Canada

Available for Immediate Shipment, Attractive Values

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

PLATERS

1—7500/3750 AMPERE, 6/12 VOLT, MUNNING "OPTIMUS."
1—6000/3000 AMPERE, 6/12 VOLT, ROGUE.
2—5000/2500 AMPERE, 8/16 VOLT, ELECTRIC PRODUCTS, 25° C.
1—5000/2500 AMPERE, 9/18 VOLT, COLUMBIA.
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ANODIZERS

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1—400 AMPERE, 40 VOLT, M. G. C., Exciter-in-head.

RECTIFIERS

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1—3200 AMPERE, 6 VOLT, S. E. COPPER OXIDE RECTIFIER.
1—GREEN SELECTSPLATER, 1500 AMPERE.

USE READER SERVICE CARD; INDICATE A 464.

Branch News

Grand Rapids Branch Establishes $500 Award Fund

CHARLES O. WERFT

Mr. Charles O. Werft, Honorary Member of the Grand Rapids Branch, has established an Award Fund of $500 for members of this Branch. The provisions are as follows:

1. These Awards are limited to members of the Grand Rapids Branch who have been in good standing for one year or more.
2. Any eligible member, whose paper is adjudged the best paper given at any particular A. E. S. Annual Convention, shall be awarded $200 from this fund.
3. Any eligible member, whose paper is adjudged the second best paper

the real old-timers who has been a member of the A. E. S. ever since it started. He is a Charter Member of the Cleveland Branch, which was formed in 1914, and was Secretary and Treasurer of that Branch from then until 1916, and was Secretary at the Annual Meeting held there in 1916. He recalls that the Cleveland Branch was the first to invite the ladies to a Convention. In 1919 he moved to Grand Rapids and transferred his membership to this Branch. Through the lean, hard years of the depression, in the early '30s, he was one of the handful who kept this Branch alive, meeting on the front steps of the Y. M. C. A. One very hot evening the meeting was held in Fulton Street Park! He was made an Honorary Member of the Grand Rapids Branch in 1949. He retired in June of 1952, and moved to the milder climate of St. Petersburg, Fla., which he terms the "Garden of the Gods".

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"Charlie" says that the A. E. S. has always been his hobby, and that he wants it to be helpful and of interest to all members. That this Branch, which he has helped to perpetuate and to prosper, holds a place in his heart is plainly shown by his establishing the Fund for these awards.

To any member of the Grand Rapids Branch, a First Place Paper is now worth

Amingo Gennex MAGNE-GAGE

Widely used for measuring the thickness of non-magnetic material or nickel which is or which can be backed by iron or steel; also nickel which is or which can be backed by non-magnetic material.

The Magne-Gage is a versatile, easy-to-use instrument for accurately measuring coatings on convex, concave, or plane surfaces, without destroying either the coating being measured or the base material. Modified Magne-Gages can be supplied to measure coatings on inside surfaces of tubes, pipes, etc. Less than 45 seconds are required to take a reading, and an accuracy of better than 10% full-scale is assured. Operation is based on the magnetic attraction of a permanent magnet to the material being measured and/or its backing, thus no electrical circuits are involved and no auxiliary equipment is required.

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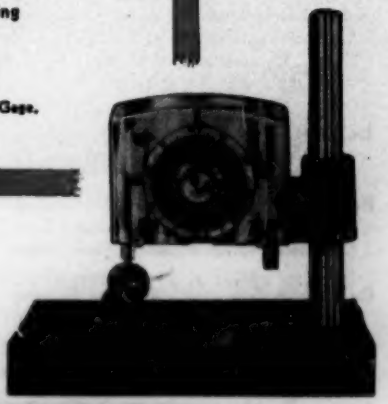
Coating on cylindrical object being measured with the Magne-Gage.



Write for Bulletin 2150-V

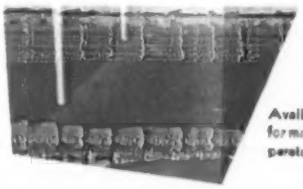
AMINCO Laboratory Instruments

AMERICAN INSTRUMENT COMPANY, INC.

Silver Spring, Maryland • In Metropolitan Washington, D. C.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 471.

THE NEW DANIELS



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7016 Euclid Ave., Cleveland 3, Ohio

APRIL, 1953 USE READER SERVICE CARD; INDICATE A 466.

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LEA Copper Glo

with the Ronal High Speed Bright Copper Plating Process*

TOPS in Brightness plus Throwing Power and Plating Speed

We take it that you, as is the case with countless other platers, are interested in getting maximum production from your existing equipment. If your problem is one of obtaining a bright, soft copper with a minimum of tank tie-up time, LEA Copper Glo can solve this in a way you cannot afford to overlook.

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SAVE NICKEL

• • •

Chrome Plate Directly on LEA Copper-Glo Copper

Burring, Buffing and Polishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions

THE LEA MANUFACTURING CO.
16 Cherry Avenue, Waterbury 20, Conn.
LEA MFG. COMPANY OF CANADA, LTD.
370 Victoria Street, Toronto 2, Canada

Available for Immediate Shipment, Attractive Values

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1—2000 AMPERE, 6 VOLT, **G. E.** COPPER OXIDE RECTIFIER.
1—**GREEN SELECTOPLATER,** 1800 AMPERE, 12 VOLT.
1—**UDYLITE-MALLORY,** 1500/750 AMPERE, 6/12 VOLT.

BUFFING LATHES

3 HP., 5 HP., 7½ HP. and 10 HP., **DIVINE, HAMMOND, M. G. C., GARDNER, TWIN** 5 HP and **TWIN** 7½ HP. **ROME,** and other popular makes.

SPECIAL

1—**MERCIL** 12 x 12 CENTRIFUGAL DRYER, Electric Heat.
4—24" and 30" **ROBBINS & MYERS** 2-SPEED VENTILATING FANS.
2—**DIVINE & PORTER** CABLE BACK STAND IDLERS.
1—**ALMCO** DB-8 TWO-COMPARTMENT 60" x 30" HORIZONTAL TUMBLING BARREL. Unlined, with motorized shaker and unloading pan, like new (can be lined).

Above is partial list only. Write to us for all your requirements for Plating, Anodizing and Metal Finishing

WIRE—PHONE—WRITE

M. E. BAKER CO.

25 WHEELER STREET

Kirkland 7-5460 CAMBRIDGE 38, MASS.

Branch News

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CHARLES O. WERFT

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3. Any eligible member, whose paper is adjudged the second best paper given at any particular A. E. S. Annual Convention, shall be awarded $100 from this fund.
4. The Fund of $500 shall be held in a bank savings account, and the interest allowed to accumulate.

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COMING EVENTS

BOSTON BRANCH

17TH ANNUAL TECHNICAL SESSION AND BANQUET
Saturday, April 18, 1953 at
Hotel Statler, Boston
Educational Session—Bay State Room at 1:30 P. M.

PAPERS AND SPEAKERS

CLIFFORD STRUYK, Technical Service Engineer, General Chemical Division, Allied Chemical & Dye Corporation, New York 6, N. Y., "Plating from Fluoborate Solutions"

DR. WALTER R. MEYER, President and Research Director, Enthone, Inc., New Haven, Conn., "Adhesion of Electrodeposits and New Methods of Cleaning and Oxide Removal"

H. C. IRVIN, President, Allied Research Products, Inc., Baltimore, Md., "Chromate Coatings"

INDIANAPOLIS BRANCH

10TH ANNUAL EDUCATIONAL SESSION AND DINNER DANCE
Saturday, April 25, 1953 at the
Antlers Hotel, Indianapolis

Measures thickness of coatings on metals the easy, accurate way

Aminco Brenner MAGNE-GAGE

Widely used for measuring the thickness of non-magnetic material or nickel which is or which can be backed by iron or steel; also nickel which is or which can be backed by non-magnetic material.

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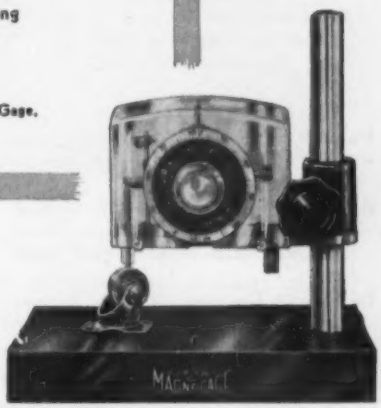
A special Magne-Gage is available for measuring composite copper-nickel coatings on steel.

Coating on cylindrical object being measured with the Magne-Gage.



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Branch News

PAPERS AND SPEAKERS

MALCOLM FOGG, Globe Chemical Company, "Electropolishing of Metals"

WALTER LOCKWOOD, Hanson-Van Winkle-Munning Company, "Manodizing"

J. T. IRWIN, Promat Division of Poor & Company, "Protective Finishes"

MILWAUKEE BRANCH

ANNUAL EDUCATIONAL MEETING AND BANQUET

Saturday, April 25, 1953 at the Schroeder Hotel

Plant visitations 9:00 A. M. to noon

Educational Session at 2:00 P. M.

Banquet at 7:00 P. M.

PAPERS AND SPEAKERS

DR. R. B. SALTONSTALL, Udylite Corporation, "Plating of Common Metals in Aqueous Solutions"

R. SCOTT MODJESKA, Scientific Control Laboratories, "Electrodeposition of Less Common Metals from Aqueous Solutions"

DR. ABNER BRENNER, National Bureau of Standards, "Electrodeposition of Uncommon Metals from Aqueous Solutions in the Future"

ROCKFORD BRANCH

11TH ANNUAL EDUCATIONAL SESSION AND BANQUET

Hotel Faust, Rockford, Ill.

Saturday, April 18, 1953

Educational Session at 1:30 P. M.,

Levin Faust Room

Banquet at 7:00 P. M., Grand Ballroom

PAPERS AND SPEAKERS

R. W. REDMOND, Process Engineer, Oldsmobile Corporation, Lansing, Mich., "Prefinishing of Steel"

MERLE YOUNG, Plating Superintendent, Electric Auto-Lite Corporation, Woodstock, Ill., "Die Castings for Electroplating"

DR. HENRY BROWN, Technical Director, Udylite Corporation, Detroit, Mich., "Porosity of Electrodeposited Metals"

BALTIMORE-WASHINGTON BRANCH

The February meeting, held at Baltimore, revolved about a fine talk on the subject of "Finishes for Aluminum Alloys". The speaker was DR. R. V. VANDEN BERG of Alcoa.

The membership application of MISS MIRIAM SHARP of the Bureau of Standards was favorably acted upon. Miss Sharp is welcomed to the Branch.

The following nominations for 1953-1954 were placed before the Branch by the Nominations Committee:

President—VINCEN J. HUGHES, JR.

Vice-President—ASAF A. BENDERLY

Treasurer—WILLIAM METZGER, JR.

Secretary—CARL H. THIEDE

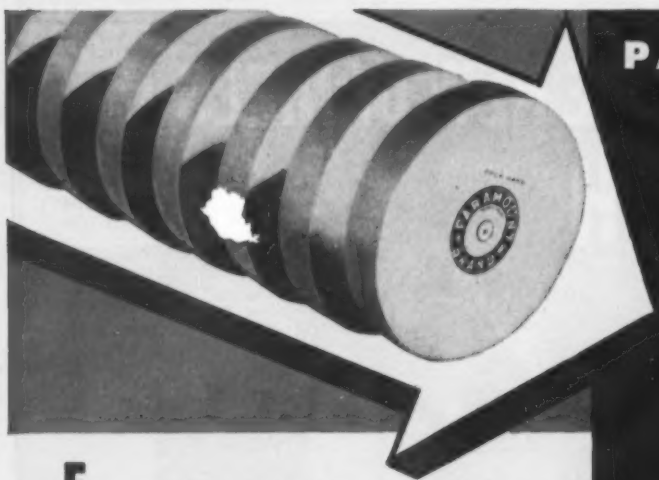
Librarian—TILLMAN J. GRESSITT

A tour of the electroforming operations at the Point Breeze Works (Baltimore) of the Western Electric Company has been scheduled for the April meeting. The day: Tuesday, April 14, 1953 at 2:00 P.M.

BRIDGEPORT BRANCH

A regular business meeting and educational session was held February 13, at the Hotel Barnum. PRESIDENT RAY GORAL turned the meeting over to LIBRARIAN FLOYD ERLENMEYER, who introduced the guest speaker of the evening, MR. W. PETER METZ of Metz Refining Company. Mr. Metz's subject, "Metallizing Non-Conductors", provoked an interesting discussion in the question-and-answer period. His talk centered on silver spray metallizing and its subsequent use in electroplating and electroforming operations.

Samples of silver sprayed products were distributed along with a brief written outline of the methods involved. JOSEPH TAMANY was accepted as an active member of the Bridgeport Branch.



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Branch News

ARTHUR MACNEIL proposed the sponsoring of WILLIAM A. EHRENCRONA for consideration by the National Society as an honorary member. An A. E. S. member of national stature will sponsor him at the annual meeting in Philadelphia.

Nominations for officers of the Branch for 1953–1954 were made as follows:

President—V. CONSALVO
1st Vice-President—P. BAILIN
2nd Vice-President—F. ERLENMEYER
Librarian—R. BONAZZO
Secretary-Treasurer—R. PARKER
Sergeant-at-Arms—J. MALLICK

After adjournment at 9:45, MICHAEL C. TAMAS of Roberts Rouge Company acted as host for the post-meeting refreshments.

BOB PARKER, *Secretary-Treasurer*

CHICAGO BRANCH

"Polishing Methods Employing New Chemical Techniques with Tumbling Barrels" was the subject at the February 13 educational session. This interesting development was presented by ART KOHLER of the Frederick Gumm Chemical Company. The use of zinc slugs in this process represents an innovation which promises high micro finishes, otherwise unobtainable in bulk metal processing.

The Branch Nominating Committee presented the following slate of officers to be voted on at the March meeting:

President—JOE ANDRUS
1st Vice-President—ELMER OLSON
2nd Vice-President—EDWARD STANEK
Secretary-Treasurer—PAUL GLAB
Librarian—RUSSELL HARR
Delegates—CLYDE KELLY, PAUL GLAB and JOE ANDRUS
Alternates—H. A. GILBERTSON, RAY LEDFORD and MARION LONGFIELD
Board of Managers—RAY LEDFORD, ART BARTMAN AND DR. MONAWECK

JOE ANDRUS is once again conducting an evening class in the techniques of electroplating at the Illinois Institute of Technology. Classes meet every Monday evening from 8:10 to 9:50 P. M.

"THEY WERE THERE"

R. E. PARKINSON of Continental Can and LEE SEABRIGHT of Acme Steel . . . a "Corina" to RUSS HARR for bringing us EILEEN DREWS . . . Makes us wonder how many lady members there are in A. E. S. . . . ART KOHLER must have been trying for the record in round trip time between Chicago and Kearny—had to catch the train back right after the meeting . . . BRUCE BELKE off again on another Eastern wing for Belke Manufacturing . . . too bad there were no seamstresses in attendance—FRANK COMPEA and J. C. KRETSCHMER of Union Special could have told them all about sewing machines . . . LARRY ROSENDAHL back again after a brief absence . . . AL KLOMPS of Sunbeam explaining deep-fat fryers to JIMMY VALLONE . . . NORBERT SAJDERA of Imperial Brass, a new attendant at our meetings . . . JOHN KURDENCK and ED ZYLSTRA in earnest conversation . . . DON CHIZ of Poray, another newcomer . . . ED WILD of R. O. Hull and ART ENGDAHL of Kocour . . . CARL BUCHHASS of Mall Tool and RUSS MILLER of Stewart-Warner . . . VIC WISKOCHIL, JOHN BENGER and H. GILLES of Illinois Watchcase . . . BILL GEISSMAN and AL OVERBEY of National Lock . . . CLARE PROUDFOOT of Bastian-Blessing . . . and a big thank-you to RALPH BELKE and FLOYD MILLER who did all the work for this reporter while he was away.

CINCINNATI BRANCH

The February 25th meeting was held at the Engineering Society Headquarters with PRESIDENT ROBERT D. MILLER in the chair. He read a letter from VICE-PRESIDENT RALPH SCHAEFER on the change in publication of the Annual Proceedings and the bound copies of PLATING.

No action was taken on a letter on Branch Exhibits at the Phil delphia convention. The membership was advised that the election of officers would be held in April rather than March due to the fact that no meeting would be held since the Educational Session and Dinner-Dance would be held then. The application of JOHN EDWARD HOOVER of the Ford Motor Company was accepted for membership. ARTHUR J. GERADA was accepted as a transfer from Detroit. Members were again advised to answer the Headquarters' questionnaire on PLATING if they had not already done so.

DICK EVANS reporting for the Picnic Committee stated that Devou Park, Cov-

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Branch News

ington, appears to be the most suitable location. It was decided to hold this event on June 6 with June 27 as second choice.

Mr. Miller introduced Joseph Gurski of the Ford Motor Company's Rouge plant. Discussing "Plating Applications on Automotive Parts", Mr. Gurski told of his work in Ford's Materials and Processing Department, their selection of coatings, methods of testing and various factors affecting the quality of plated finishes, particularly on die castings.

J. C. Miller Company were hosts for the social hour which concluded the meeting.

Charles Wise, *Secretary*

DETROIT BRANCH

On January 9, a joint meeting was held with the Detroit Section of the Electrochemical Society. Approximately 110 members and guests were present.

Four new members were elected into the branch.

Secretary-Treasurer Gurski urged all to reply to the questionnaire from Headquarters.

Educational Chairman Fred Olmstead announced that the night's educational program had been planned with the cooperation of Wright Wilson, Electrochemical Society Entertainment Chairman.

Part II of the International Nickel Company's color film, "Corrosion in Action" was shown.

Dr. Abner Brenner, Chief of the Electrodeposition Section, National Bureau of Standards, was the principal speaker. His subject, "Electrodeposition of Some of the Less Common Metals from Non-Aqueous Solutions", clearly showed how the National Bureau of Standards is developing and broadening the entire field of electrodeposition. There is little, if any, published information on this still obscure but vastly important method of electroplating.

Brenner said that the principal methods of non-aqueous deposition are from fused salt baths and from baths based on organic solvents. The plating of titanium and molybdenum from fused salt baths was discussed in some detail and samples of the electrodeposits were distributed for examination. Smooth, non-porous deposits are not yet possible with either metal.

It was evident from the number of questions asked following the talk that the subject was of great interest to many.

Refreshments were served after adjournment of the meeting at 10:00 P. M.

E. J. Kubis, *Publicity Chairman*

LOS ANGELES BRANCH

Librarian Stuart Krentel again did an outstanding job in securing Dr. Wil-

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Branch News

LIAM BLUM as the speaker for the February meeting, and one of the largest audiences of the year was on hand. Dr. Blum's talk, "A Summary of the Researches on Electrodeposition at the National Bureau of Standards", was accompanied by additional slide data.

He gave a general summary of his many years in the service of the government and many of the projects with which he had been associated, such as one of his first, electrotyping with copper and nickel. Among the newer projects he listed one involving radioactive tracer studies of chromium plating solutions. Another research program of extreme importance was done on nickel, and Dr. Blum reviewed the many important facts which had been derived from this study. Probably one of the longest projects, and still in existence, since testing of the deposits and the establishment of a rating system is of such a complex nature, is the one dealing with standard plating specifications.

Dr. Blum also described how testing instruments such as the Magne-Gage and Spiral Contractometer were developed by the Bureau to check their own work, and stated that work is still continuing for a more simple method of checking adhesion.

Further discussion by Dr. Blum covered some of the points involved in electroplating metals from non-aqueous baths in which fused salts or organic solutions are used. He finished his talk with the observation that all of his years in the research end of plating only show how much more work there is to be done. A question and answer period followed the talk.

The meeting was adjourned at 9:40 P. M. by PRESIDENT MYRON ORBAUGH.

EARL W. ARNOLD, *Secretary*

LOUISVILLE BRANCH

A regular meeting was held January 15, at Korfhages Restaurant, 1482 Preston Street, Louisville, with a dinner served at 6:45 P. M. PRESIDENT ARTHUR A. OERTEL opened the business and open meeting at 8:00 P. M. with 32 members and guests present.

A letter was read from the Philadelphia Branch asking the Louisville Branch to support DR. SAMUEL HEIMAN for the Third Vice-Presidency of the Society at the National Convention.

Another letter from Branch Exhibits Chairman of the National Convention requested participation in the Branch Exhibits at Philadelphia. After discussion, it was decided that Louisville Branch was not prepared to submit an exhibit at this time but may do so in the future.

ED BRUCK, of the Indianapolis Branch and a very welcome guest of the Louisville Branch, announced that Indianapolis will hold an Educational Session and Dinner-Dance Saturday, April 25, 1953 and Ed promised that everyone who will attend will have a very good time. Ed also stated that the Dayton Branch will hold an Educational Session and Dinner-Dance on Saturday, April 18, 1953. S. J. BEYER introduced MR. J. V. DAVIS of the Udylite Corporation, Detroit, Mich., as the speaker of the evening. Mr. Davis in his talk on "Savings by Use of a Full Automatic Machine" explained the superiority of having a machine do the cleaning, pickling, and plating operations as compared to hand operations. It was pointed out that the timing control, the flexibility and efficiency of operation and quality can be much better controlled by automatic machines. Work loads are much higher in production thereby reducing costs. Pictures were shown with a commentary by Mr. Davis.

Refreshments, courtesy of MR. V. J. KELLY and the Udylite Corporation, Detroit, Mich., were served after the question and answer period.

Meeting adjourned at 10:30 P. M.

J. C. STERLING,
Secretary-Treasurer

NEWARK BRANCH

A regular meeting was held on January 16.

RAYMOND ABAZIA was elected to membership and the transfer of MILTON F. STEVENSON to Syracuse Branch was approved.

DR. FOULKE gave a brief report of the annual interim meeting, after which LIBRARIAN TOM AUSTIN introduced the speaker of the evening, MR. GERALD LUX of the Oakite Products Company. His subject was "Fundamentals of Electrocleaning".

The regular February meeting was held on the 20th. Librarian Austin introduced BRYANT GARDNER of the Chemical Corporation as the first speaker of the evening. His topic was "Resin Bonded Fiberglas Plating Tanks". He showed motion pictures of the material being processed into tanks and exhaust equipment.

A communication from DR. GEORGE SWIFT with reference to the Boston Branch Banquet, April 18, and one on the New England Regional Meeting which will be held at Springfield, Mass., on May 9, were read.

HORACE LAWTON was elected to membership and the transfer of B. C. CASE to Chicago Branch was approved. Resignations of MR. M. DITZE and MR. L. E. SULLIVAN were accepted.

Suspended for non-payment of dues were GEORGE BELLROSE, JOSEPH CALABRESE, JULES FALK, DONALD HAYES, HOWARD HESS, CYRIL HAMLIN, JAMES TRAVIS, and STEVE YACUS

MR. DIGGIN made a motion that the Newark Branch request the convention for 1963 to be held at Atlantic City. The motion was carried. The slogan adopted was "Down by the Sea in '63".

The next speaker of the evening, E. E. OATHOUT of the Behr Manning Corporation, Troy, N. Y., talked on "Mechanical Polishing with Coated Abrasives". Mr. Oathout delivered an extremely masterly talk and, with the help of slides, showed the different types of abrasive best for wood, metals, leather; and how difficult problems were solved in numerous industries by means of abrasive belt finishing.

Meeting adjourned at 10:15 P. M.

GEORGE REUTER,
Recording Secretary

NEW YORK BRANCH

The Annual Educational Session and Banquet was held at the Hotel Statler on February 14. At the educational session, presided over by PETER VEIT, the following National officers were introduced: President, F. J. MACSTOKER; First Vice-President, G. P. SWIFT; Past President, C. F. NIXON, and Executive Secretary, D. G. FOULKE.

Speakers for the day were P. STEVENS, Chemist, Kenmore Metal Products Company, on the subject, "Economic Advantages of Preplated Wire"; C. F. NIXON, General Motors Corporation, on the subject, "What Is Quality"; and DR. LOUIS WEISBERG, Consultant, on the subject, "What of Tomorrow".

The ladies held their usual tea and card

Photos from the Annual Educational Session and Banquet of the New York Branch

party while the technical session was being conducted. Many prizes were awarded to those attending the tea which was presided over by CHARLES E. SCHLOTT.

At the Banquet held in the evening 578 persons thoroughly enjoyed themselves. Seen during the festivities were E. L. COMBS, General Chairman of the 1955 Cleveland Convention, and his pretty wife talking to the GEORGE SCHORES . . . a contingent from the Nutmeg State, EARL COUCH, BILL EHRENCRONA . . . GEORGE WAGNER and party from Newark . . . and MR. and MRS. C. TEMPLE. The various committees that worked to make the affair such a successful one are to be complimented.

L. LEVINSON, *Recording Secretary*

PHILADELPHIA BRANCH

The January meeting was held on the 23rd at Mosebach's Restaurant and was preceded by a dinner with more than 70 attending. Speaker for the evening was R. V. VANDEN BERG, of the Aluminum Company of America, whose topic was "Anodizing and Plating of Aluminum". He gave a very comprehensive and lucid dissertation on the theories and methods of plating aluminum, discussing the roughening, oxidation and metallic film types of preparation. He felt the zincate method to be the most practical for production purposes and gave formulae for zincate dips and copper strike baths. The balance of Mr. Vanden Berg's talk was devoted to a discussion of chromic and sulfuric acid methods of anodizing, including the new "hard" type of coating. The entire presentation was well illustrated with excellent slides.

The February meeting was held at the Harrison Laboratory on the 27th with 40 attending. Ten new active members were admitted. The chairman of the Nominating Committee presented a slate of candidates for the 1953–1954 term. The secretary spoke about the proposed publication policy change for PLATING and also announced the recently voted increase in dues. A motion was passed that MR. FRED FULFORTH be nominated for the Order of the Pot.

DR. SAMUEL HEIMAN announced that the rectifier exhibited at the meeting belonged to the electroplating class and had been made possible through the generosity of the Udylite Corporation, who donated $50.00 for the purchase of the parts, and MR. EUGENE ZURBACH, who gave freely of his time to assemble the parts into the completed rectifier.

The speaker for the evening was BRYANT H. GARDNER of the Chemical Corporation, who presented a film on "Resin Bonded Fiberglas in the Electroplating Field". It showed method of manufacture and typical uses of tanks, piping and ducts made from this new material.

I. WM. MARCOVITCH, *Secretary*

PITTSBURGH BRANCH

Forty members attended the January meeting held at the Sheraton Hotel.

Elected to membership were FRANKLIN CUTSHAW, Aero Supply Company; HARRY A. EARLY, HENRY J. SCHALTENBRAND, Pittsburgh Commercial Heat Treating, and HAROLD L. FRANKS, Oakite Products.

Speaker for the evening was WALTER L. PINNER, Houdaille Hershey Corporation, Detroit, Mich., whose subject was "Possibilities for the Future". He enumerated some of the problems confronting the plating industry and indicated that these would be problems for research in the future. A number of slides were screened pertaining to polishing of steel and also showing the imperfections in the plated surface as a result of improper polishing of the base metal.

R. H. SCHINDLER,
Secretary

ROCHESTER BRANCH

On Tuesday evening, January 27, a joint meeting of the Rochester Branch A. E. S. and the Organic Finishing Group of the Industrial Management Council was held at the Rochester Chamber of Commerce. Good attendance by members of both groups provided an interested audience for the speaker, DR. C. E. PICKETT, Chief of Paint and Chemical Laboratory, Laboratory Service Division, Development and Proof Service, Ordnance Corps, Aberdeen Proving Grounds. Dr. Pickett spoke on "Phosphate Coatings and Government Paint Systems". Exhibited during the course of the talk were sample panels illustrating the finishing systems described.

The February meeting was held on the 16th at 8:15 P. M. at the 40 & 8 Club, 933 University Avenue. During the business meeting the following men were welcomed

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The PERMAG line of cleaning compounds for the electrolytic cleaning process of the plating industry makes possible a solution for every cleaning problem.
With the skill and knowledge developed in over 30 years of service, PERMAG cleaning compounds are designed to provide maximum cleaning efficiency at the lowest possible cost to ease your daily operations and increase production.
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into membership by PRESIDENT LENZI: PHILLIP RONCO, PASQUALE TRIMALDI, WILLIAM KUSHNER and ELMER POHL. Ideas for a Branch Exhibit at the Philadelphia Convention were requested by SECOND VICE-PRESIDENT CHARLES FIDEOR. Appointed to a Nominating Committee to nominate a slate of officers for the Rochester Branch for 1953–1954 were: F. DOUGHERTY, J. HULL, R. FLINT and R. GRAHAM. Appointed to plan the May meeting were R. BERGHOLD, V. SCHAEFFER and D. BLUM. As the educational portion of the evening, International Nickel's very fine movie, "Corrosion in Action", was shown. Following the movie refreshments were served as usual.

E. WALLIN, *Secretary*

ST. JOSEPH VALLEY BRANCH

A regular monthly meeting was held at the Hotel Elkhart, Elkhart, Ind., on February 4. Thirty-two members and guests attended the dinner and 47 the technical session.

MR. RICHARD MCDOWELL was elected to membership in the society. ACTING PRESIDENT WM. MCDOWELL read a report of the Interim meeting for JOHN LOCKERBIE, who attended the meeting as our representative.

The following Delegates and Alternates were elected for the 1953–1954 fiscal year:

Delegates—HAROLD J. WIESNER, CHESTER MCDOWELL and ELMER BRADY

Alternates: WILLIAM MCDOWELL, RALPH D. WYSONG and EUGENE ROTH

The following Nominating Committee was appointed: DR. HAROLD J. WIESNER, DR. ERNEST J. WILHELM and JAMES HEDGES.

The secretary-treasurer was instructed to send the Branch Research Fund money due to the National headquarters.

The meeting was then opened for a 10-minute question and answer period for current plating problems. Discussion covered the following three questions: (1) What causes black smut on zinc anodes when the composition of the bath is correct and what can be done to eliminate this condition? (2) What is a practical solution to plating troubles due to cleaning of cast iron parts? (3) Is there a practical way for replating nickel plated parts without unracking and nickel buffing before replate?

Guest speaker, TOM C. COMER, was introduced. In his paper, "The Vacuum Metallizing Process", Mr. Comer showed applications of this process with a multitude of samples and illustrated slides to acquaint the group with the variety of uses for the high vacuum, coating process.

He outlined the normal procedure as follows: Work is placed on a jig which is then put into the vacuum container. The work may be coated with lacquer before it is placed on the metallizing jig. Aluminum high vacuum deposits are about 4 millionths of an inch thick and are usually protected with a lacquer. It is possible to have four cycles per hour but as high as six cycles have been attained. Most of the time is used to create the high vacuum, the actual metallizing taking little time since it depends only on the heating required to bring a tungsten filament to such temperature as to boil the aluminum or other metal clips which are hung on the tungsten filament.

Other pure metals besides aluminum, such as gold, silver, chromium, rhodium, etc., have been metallized successfully.

EUGENE ROTH, *Secretary-Treasurer*

SAN FRANCISCO BRANCH

A regular monthly meeting was held on January 22, at the El Curtola Restaurant, 510 17th Street, Oakland, Calif. The meeting was called to order by J. R. PATTENGER, President, and turned over to our guest speaker, MR. HUBERT M. GOLDMAN, Chemical Engineer of Enthone, Inc., New Haven, Conn.

Mr. Goldman's timely subject was "Adhesion of Electro-deposits and New Methods of Cleaning and Oxide Removal". He accompanied his talk with practical cell demonstration.

Mr. Pattenger appointed a committee to prepare a slate of candidates for the new fiscal year. The committee members were as follows: JACK ULRICH, Chairman; MR. LANE and MR. ALEXANDER.

In the absence of our secretary, no further business was handled and the meeting was adjourned with 24 members attending.

HORACE J. SMITH,
Secretary-Treasurer

SYDNEY BRANCH

The annual Dinner and Smoke was held at Roselands Golf Club and again this turned out to be a grand night. There were 24 members present and the evening consisted of an excellent dinner, refresh-

(*Continued on page 418*)

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Membership Report of the A. E. S.

Elections

BRIDGEPORT: J. Henry Bonney, Flavio W. Foglio, Joseph Haas, Jack A. McCarthy, Edward J. Rubin, Salvatore Sileo, Thomas F. Sullivan, Joseph A. Tamany, Charles F. Wallace, Jr., Joseph Zigmont

CLEVELAND: Jay J. Becker, S. D. Brode, W. J. Buisman, Robert H. Christenson, Howard S. Jenkins, Leo W. Johnson, Erich X. Kreuzer, Paul G. Lackney, Maurice B. Orndorff, John Parina, Jr., Edward A. Perry, Allen D. Russell, George E. Shallop, Charles E. Speer, Steven Tachovaka, William Tuttle, Howard E. Wolf

DETROIT: E. Robert Breining, Eugene V. Ivanso

HOUSTON: Albert N. D'Amico, Grover A. Krone

INDIANAPOLIS: Joseph A. Downey, Paul B. Freeman, William E. Layton, Robert E. Nance

NEWARK: Raymond Abazia, Oliver R. Jackson, John R. Miglin, Emil Torsh

NEW HAVEN: Frederick E. Allen, Sr., Louis Campano, William T. Donahue, Andrew B. Hendryx, George W. La Francis, Bernard J. Orosz, Jr., Harry R. Taylor, Frank J. Tokarski

SAGINAW VALLEY: Daniel P. Waits, E. P. Walsh

ST. JOSEPH VALLEY: Richard McDowell

SYDNEY: Harold F. Roberts

WICHITA: Ogle F. French, Leon R. Lawless, Robert E. Samuelson, Harvey Shaw, James Springer, Walter H. Turner, Carl H. Wilson, Newton R. Winn

MEMBER-AT-LARGE: Friedrich-Wilhelm Brinkman, Detmold, British Zone, Germany; Hector Andrade Caretta, Mexico, D. F.; Dr. Rolf Cransberg, Loosdrecht, Holland; Harry A. Mackie, Detroit, Mich.; W. C. Enders, Oklahoma City, Oklahoma

Reinstatements

LOS ANGELES: Ernie Hamor (Returned from Military Service)

PHILADELPHIA: Charles E. Salmon, Jr.

Transfers

Edward C. Loeffel to New York from Bridgeport; John Gade from Pittsburgh to Cleveland; James L. Kelch from Pittsburgh to Cleveland; R. E. Shaw from Pittsburgh to Cleveland; James E. Fritts from Columbus to Detroit; William E. Trembley to Dallas-Ft. Worth from Houston; Milton F. Stevenson to Syracuse from Newark; Arthur H. Stevens to Waterbury from New Haven; M. F. Hiles to Kansas City from Member-at-Large

Membership Competition

	Membership Apr. 1, 1952*	New Members	Net Change in Membership	Per Cent Net Change
First Group				
Toronto	132	17	+17	+12.1
Milwaukee	145	19	+15½	+10.7
New York	305	40	+32½	+10.7
Bridgeport	154	13	+11	+ 7.1
Cleveland	212	29	+15	+ 7.1
Grand Rapids	155	17	+ 9	+ 5.8
Detroit	491	39	+14	+ 2.9
Hartford	148	9	+ 4	+ 2.7
Pittsburgh	132	17	+ 3	+ 2.3
Newark	240	18	+ 5	+ 2.1
Los Angeles	218	17	+ 4	+ 1.8
Boston	140	5	+ 2	+ 1.4
Chicago	469	56	+ 1	+ 0.2
Melbourne†	168	19	− 8	− 4.8
Philadelphia	203	13	−10	− 4.9
Second Group				
Saginaw Valley	71	16	+16	+22.5
New Haven	88	15	+15½	+17.6
Rochester	88	22	+15	+17.0
Montreal	72	8	+ 7	+ 9.7
St. Louis	102	8	+ 8	+ 7.8
Cincinnati	80	7	+ 5½	+ 6.3
Syracuse	104	16	+ 6	+ 5.8
Indianapolis	114	10	+ ½	+ 0.5
Waterbury	115	1	0	0
Buffalo‡	107	4	− 1	− 0.9
Baltimore-Washington	96	5	− 2½	− 2.6
St. Joseph Valley	74	7	− 2½	− 3.4
Providence-Attleboro	92	6	− 3½	− 3.8
Dayton	81	7	− 3½	− 4.3
Sydney	86	6	− 4	− 4.7
Rockford	79	3	−15	−18.9
Third Group				
Wichita	...	20 (19)	+20	+105.3
Louisville	24	25	+23½	+ 97.9
Toledo	39	11	+15	+ 38.5
Houston	40	13	+ 9	+ 22.5
Western Ontario	19	8	+ 4	+ 21.1
Southeastern	47	16	+ 7½	+ 16.0
Hamilton	22	3	+ 3	+ 13.6
San Francisco	67	13	+ 8	+ 11.9
Kansas City	...	4 (34)	+ 4	+ 11.8
Dallas-Fort Worth§	69	15	+ 7½	+ 10.0
Adelaide	58	6	+ 6	+ 10.3
Allentown-Reading	44	4	+ 4½	+ 10.2
Jackson-Lansing	59	6	+ 5	+ 8.5
Twin-City	66	9	+ 3½	+ 5.3
Springfield	55	4	+ 2½	+ 4.5
Lancaster	67	6	+ 3	+ 4.5
Columbus	54	7	− 1½	− 2.8
Outside Competition				
At Large	125	27	+17½	.....
In Transfer	23	..	.....	.....
Total A. E. S.	5,739	719	+298½	+ 5.2

Active Membership, March 1, 1953 6,090

*Subject to correction. †, ‡, §Winners in first, second and third group, respectively, of 1951–1952 membership competition.

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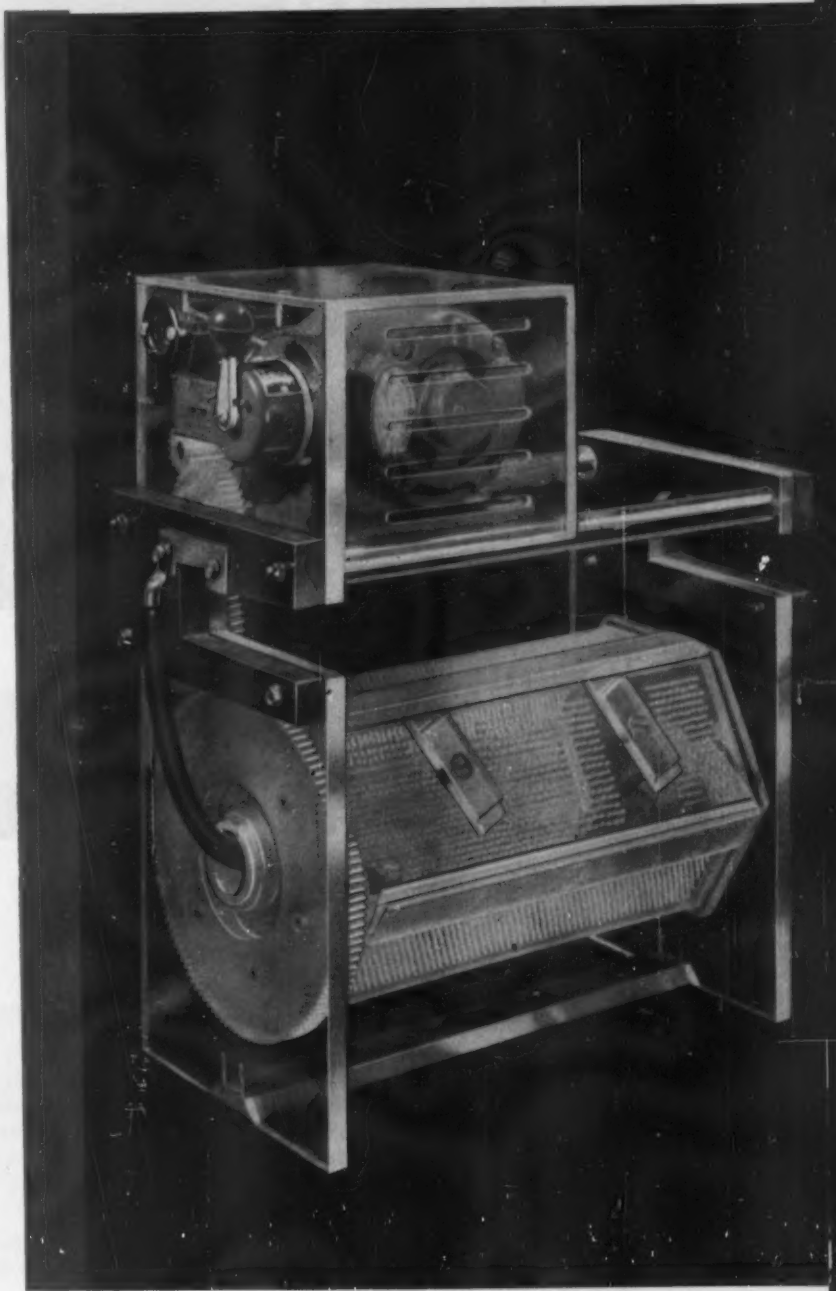
THE STUTZ PORTABLE PLATING BARREL is designed and constructed of High Temperature Lucite to provide continuous processing of piece parts through the operations of Alkali Cleaning, Water Rinsing, Acid Treatment and Plating. Progression through these operations is made by manual handling or if necessary with the assist of an overhead traveling hoist. The Stutz Portable Plating Barrel is made in 2 sizes with cylinders having inside dimensions of 6" x 12" and 8" x 18". Standard perforations are 3/32". Smaller or larger openings can be furnished as required. All gears are of 1/2" High Temperature Lucite. Gear bearings are permanently lubricated. Operating temperature up to 185° F.



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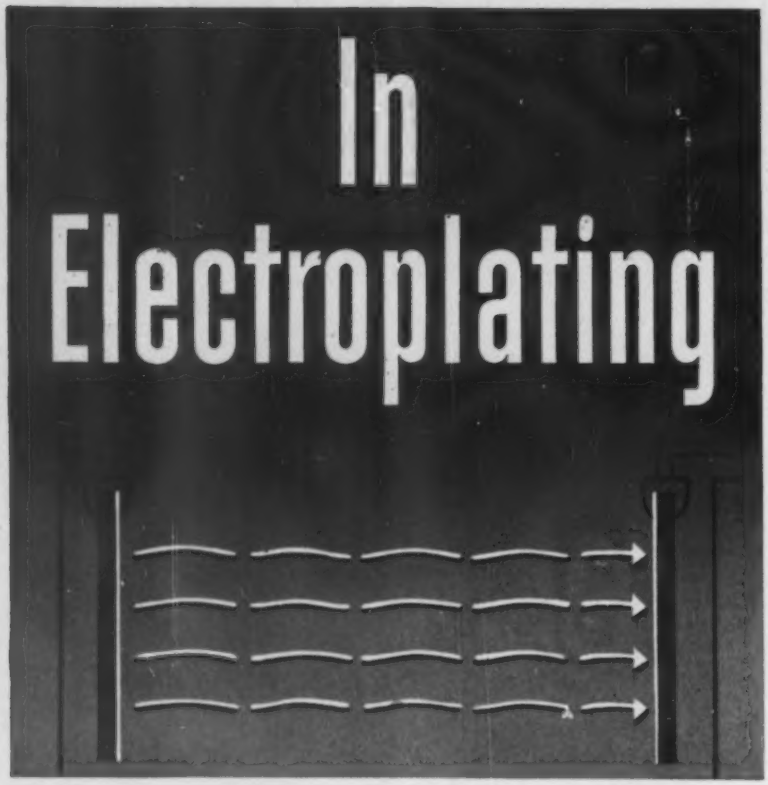

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Resignations

INDIANAPOLIS: Harold H. Lurie
SYDNEY: V. J. Long
SYRACUSE: George C. MacEwan
MEMBER-AT-LARGE: Robert C. Bray, Marvin E. Blumberg, William W. Sellers

Suspensions

NEWARK: George Bellrose, Joseph Calabrese, Jules Falk, Cyril Hamlin, J. Donald Hayes, Howard Hess, James F. Travers, Steve Yacus

MEMBER-AT-LARGE: Fabio Becker, R. Caro, Robert M. DeTray, Jaime Estruch, L. C. Hamilton, Joaquin A. Marly, Earl S. Patton

Branch News

(*Continued from page 414*)

ments and entertaining artists. A most enjoyable evening was had by all and there were a few who went home a little richer and some a little wiser.

The next social affair will be the entertaining of DR. BLUM and, from past experiences, this night will be one not to be missed.

E. BRIDGEMENT,
Secretary-Treasurer

SYRACUSE BRANCH

The January meeting was held at the Moose Hall on the 19th with 34 members and guests present. A Dutch treat dinner of Dutch steak was served those attending the dinner.

MR. J. A. BADALUCO, Vice-President of the J. C. Miller Company, Grand Rapids, Mich., spoke on the topic, "Tripoli as an Abrasive". He supplemented his talk with a color film on the mining of tripoli. Many questions were answered and the meeting was enjoyed by all. Refreshments were provided by Oakite Products, Inc., New York, N. Y., with their representative, BOB COLVIN, as host.

The February meeting was held at Bill Richards Restaurant, 106 Ashdale Avenue, Syracuse, N. Y., on the 16th. Thirty-five members and guests attended and enjoyed a pre-meeting meal of roast beef.

The speaker of the evening, MR. WILFRED S. MCKEON, President, Sulfur Products Company, Inc., Greensburg, Pa., was ill and unable to give his paper. In his absence MR. GEORGE CAVANAUGH, General Electric Company, Syracuse, N. Y., read Mr. MCKEON's paper on "Copper Stripping Non-Dangerously". George was more than equal to the task and the meeting was enjoyed by all.

Refreshments were provided for by the Sulfur Products Company, Inc., with George Cavanaugh acting as host. Wishes for Mr. McKeon's speedy recovery were expressed by the Branch.

LINDLEY S. WOOD, *Secretary*

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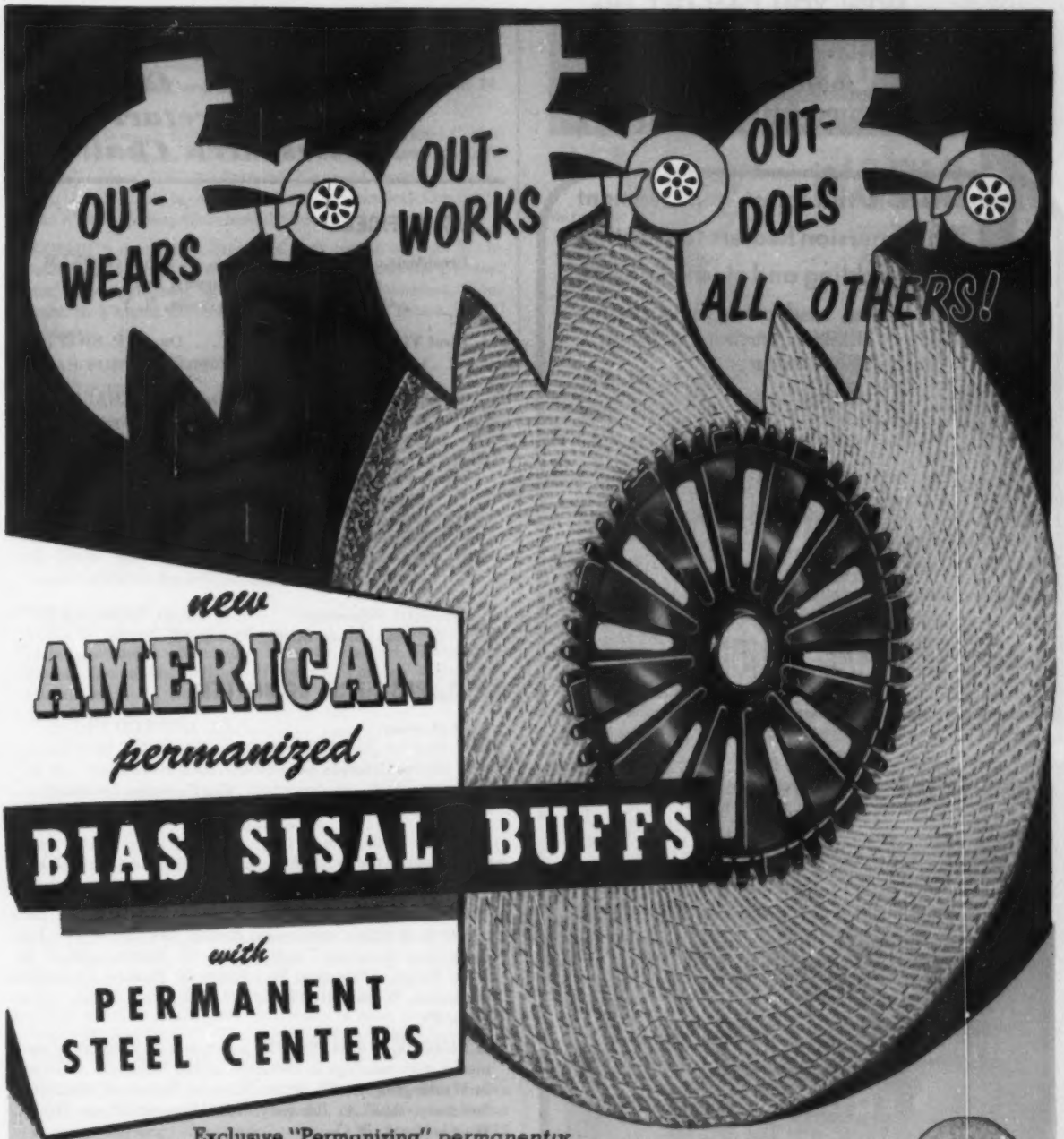

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Cleveland Graphite Bronze Company
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11-104 General Motors Research Building "A"
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A. E. S. RESEARCH COMMITTEE

Chairman.....Dr. DONALD PRICE
Oakite Products, Inc.
40 Thames Street, New York 6, N. Y.
Secretary.....The Executive Secretary

ADELAIDE, AUSTRALIA meets second Wednesday of each month. Address G.P.O. Box 598E, Adelaide, S. A., Australia.

ALLENTOWN-READING meets third Wednesday of each month in Scotty's Anchorage, Second and Main Sts., Emmaus, Pa. Secretary-Treasurer, Lee C. Wotring, 526 N. St. Elmo Street, Allentown, Pa. Research Finance Committee Chairman, William R. Pfeiffer, Jr., 975 Green Street, Allentown, Pa.

BALTIMORE-WASHINGTON meets second Tuesday of each month with meetings in Baltimore at the Engineers' Club and in Washington, D. C., at the National Bureau of Standards. Secretary, Asaf A. Benderly, 1829 Summit Place, N. W., Washington 9, D. C.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown 72, Mass. Research Finance Committee Chairman, Louis V. Gagnon, 53 High Street, Natick, Mass.

BRIDGEPORT meets second Friday of each month in Barnum Hotel. Secretary-Treasurer, Robert G. Parker, 25 Beverly Road, Trumbull 58, Conn.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary and Research Finance Committee Chairman, B. P. Fortin, Jr., 209 Forest Drive, Orchard Park, N. Y.

CHICAGO meets second Friday of each month at 6 P. M. at Western Society of Engineers, 84 E. Randolph Street. Secretary-Treasurer, Paul Glab, 882 N. Paulina Street, Chicago, Ill. Research Finance Committee Chairman, William B. Johnson, c/o Industrial Filter & Pump Manufacturing Company, 5914 Ogden Avenue, Chicago 50, Ill.

CINCINNATI meets fourth Wednesday of each month at 8 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary, Charles Wise, c/o The Buckeye Products Company, 7020 Vine Street, Cincinnati 16, Ohio.

CLEVELAND meets first Friday of each month in Hotel Carter at 8 P. M. Secretary-Treasurer, A. J. Lupien, 4408 Carnegie Ave., Cleveland 3, Ohio. Research Finance Committee Chairman, John D. Little, c/o The Harshaw Chemical Company, 1945 E. 97th Street, Cleveland 6, Ohio.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer, John Soderberg, 40 W. Long Street, Columbus, Ohio. Research Finance Committee Chairman, Fred Brune, R. D. 7, Marion, Ohio.

DALLAS-FORT WORTH. Secretary-Treasurer, A. C. Fricke, 1415 Plowman Avenue, Dallas 8, Texas.

DAYTON meets first Friday of each month in Engineers Club. Secretary, Harry Brown, 516 Boulevard, Dayton 9, Ohio. Research Finance Committee Chairman, Robert L. Ruleff, 1002 Broadview Boulevard, Dayton 9, Ohio.

DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, Joseph Gurski, 8885 Littlefield, Detroit 28, Mich. Research Finance Committee Chairman, Bruno Leonelli, 238 Rhode Island, Highland Park 3, Mich.

GRAND RAPIDS meets second Friday of each month at 7:00 P. M. for dinner; educational session at 8:15. Meeting place to be announced. Secretary, Kenneth Hampel, 136 Elwood Street, Grandville, Mich. Research Finance Committee Chairman, J. D. Kershaw, Jr., 904 Mayhew Wood, S. E., Grand Rapids, Mich.

HAMILTON BRANCH meets third Thursday of each month in the Conference Room, West End Plant, Canadian Westinghouse Company, Ltd. Secretary, R. Burke, c/o Swift Devices, 14 George Street, Hamilton, Ontario, Canada.

HARTFORD meets third Monday of each month in Hotel Bond. Secretary, Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research Finance Committee Chairman, Frank W. Smith, 46 Cottage Street, Meriden, Conn.

HOUSTON meets third Tuesday of each month at 6:30 P. M. in the Ben Milam Hotel, Houston. Secretary-Treasurer, C. A. Mattiza, P. O. Box No. 9312, Houston, Texas.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 E. Washington Street. Secretary, Miss Edna Rohrabaugh, 816 Robert Street, Lafayette, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Meadow Lark Inn in Jackson and Porter Hotel in Lansing. Secretary-Treasurer, W. H. Mogle, 1623 Wildwood, Jackson Mich. Research Finance Chairman, J. H. Hoefer, 5440 Meridian Road, R.R. 6, Jackson, Mich.

KANSAS CITY—Secretary-Treasurer, Olin K. Bock, 5317 W. 58th Street, Mission, Kansas.

LANCASTER meets second Friday of each month at 8 P. M. September, December and April meetings are held at Hanover, York and Harrisburg, respectively; all other meetings at the Old Mill Inn, Lancaster, Pa. Secretary-Treasurer, Harry A. Saylor, 40 N. Poplar Street, Elizabethtown, Pa. Research Finance Committee Chairman, Harry Hovis, Lincoln Highway, West Lancaster, Pa.

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Rodger Young Auditorium. Secretary, Earl W. Arnold, 3628 E. Olympic Boulevard, Los Angeles 23, Calif. Research Finance Committee Chairman, Earl Coffin, 5102 Marburn Avenue, Los Angeles 43, Calif.

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LOUISVILLE meets third Thursday of each month in Room 119, Speed Scientific Building, University of Louisville. Secretary-Treasurer, Joseph G. Sterling, 1169 Keller Avenue, Louisville, Ky. Research Finance Committee Chairman, T. K. Allison, 301 W. Main Street, Louisville 2, Ky.

MELBOURNE, AUSTRALIA meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Honorary Secretary-Treasurer, S. B. Pearce, G. P. O. Box 4591, Melbourne, Australia.

MILWAUKEE meets first Friday of each month in the East Room, Hotel Ambassador. Secretary-Treasurer, E. E. Piellusch, 2921 S. 90th Street, West Allis 14, Wis. Research Finance Committee Chairman, T. D. Hartshorn, 4818 N. Woodruff Avenue, Milwaukee 11, Wis.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary, J. T. Reisenburg, Jr., 996 DeBullion Street, Montreal, P. Q., Canada. Research Finance Committee Chairman, P. M. Coady, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, P. Q., Canada.

NEWARK meets third Friday of each month at 8 P. M. in Hotel Robert Treat. Secretary-Treasurer, George Wagner, Hy-Grade Electro Plating Company, 35 Fourth Street, Newark, N. J. Research Finance Committee Chairman, Edwin Bowerman, 166-41 17th Avenue, Whitestone, N. Y.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Hamden 14, Conn. Research Finance Committee Chairman, Dr. H. L. Kellner, c/o Lea Manufacturing Company, 16 Cherry Avenue, Waterbury 86, Conn.

NEW YORK meets second and fourth Fridays of each month in Statler Hotel. Secretary-Treasurer, George Schore, 150 Bennett Avenue, New York 33, N. Y. Research Finance Committee Chairman, George F. Hermann, 52 Chestnut Street, Brooklyn 8, N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa. Research Finance Committee Chairman, Brooks Ricca, 332 Lantwyn Lane, Narberth, Pa.

PITTSBURGH meets second Thursday of each month in the Avon Room of Sheraton Hotel. Secretary, R. H. Schindler, 125 Fairfax Road, Forest Hills, Pittsburgh 21, Pa. Research Finance Committee Chairman, S. S. Johnston, c/o Weirton Steel Company, Weirton, W. Va.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence Engineering Society Hall, 195 Angell Street, Providence, R. I. Secretary, George A. Gibbs, 65 Farragut Avenue, Providence, R. I. Research Finance Committee Chairman, Pierre B. Lonsbury, 78 North Avenue, Attleboro, Mass.

ROCHESTER meets third Monday of each month at the Forty Over Eight Club, 933 University Avenue. Secretary, Edwin Wallin, 70 Peach Tree Road, Penfield, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester, N. Y.

ROCKFORD meets second Monday of each month in Faust Hotel. Secretary, Kenneth Kieselburg, 419 Theodore Street, Rockford, Ill. Research Finance Committee Chairman, David Stockton, The Udylite Corporation, 1943 Walnut Street, Chicago 12, Ill.

SAGINAW VALLEY meets for dinner at 7 P. M. and meeting at 8 P. M. at Zenders, Frankenmuth, Mich., second Wednesday of each month, September through May except February. Secretary-Treasurer, G. L. Gutscher, Jr., 2512 Walter Street, Flint, Mich. Research Finance Committee Chairman, Alfred Knight, 113 S. Farragut Street, Bay City, Mich.

ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Hotel Elkhart, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 739 N. College Street, South Bend 28, Ind. Research Finance Committee Chairman, John Bayman, 1430 East Madison Street, South Bend, Ind.

ST. LOUIS meets second Wednesday of each month at the York Hotel, 6th and Market, St.Louis Mo. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo. Research Finance Committee Chairman, Dale Bolyard, 1803 Alfred Street, St. Louis 10, Mo.

SAN FRANCISCO meets third Thursday of each month, alternating between St. Julien Restaurant, 140 Battery Street, San Francisco, and El Curtola Restaurant, 510 17th Street, Oakland. Secretary-Treasurer, Horace J. Smith, 319 Alta Loma Drive, South, San Francisco, Calif. Research Finance Committee Chairman, Alan Baker, 10 Bluxome Street, San Francisco, Calif.

SOUTHEASTERN meets second Friday of each month in the Georgia Hotel, Atlanta, Ga. Secretary-Treasurer, W. T. Weymouth, 173 Clay Street, S. E., Atlanta, Ga. Research Finance Committee Chairman, Dr. Fred Cox, Georgia School of Technology, Atlanta, Ga.

SPRINGFIELD meets fourth Monday of each month in Hotel Charles. Secretary, R. J. Girard, 145 Waite Avenue, Chicopee Falls, Mass. Research Finance Committee Chairman, James Laing, c/o Van Valkenburg Company, Montgomery Street, Willimansett, Mass.

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SYRACUSE meets third Monday of each month in Loyal Order of Moose Hall, 643 W. Onondaga Street. Secretary, Lindley Wood, 1329 Bellevue Avenue, Syracuse 4, N. Y. Research Finance Committee Chairman, George W. Cavanaugh, 129 Kenwood Avenue, Syracuse, N. Y.

TOLEDO meets first Thursday of each month at Commodore Perry Hotel. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, Robert L. Edwards, 1106 Dovercourt Road, Toronto, Ont., Canada. Research Finance Committee Chairman, C. D. Short, 1281 Pape Avenue, Toronto, Ont., Canada.

TWIN CITY meets first Monday of each month, October through June, in the Covered Wagon (Lodge Room), 114 S. 4th Street, Minneapolis, Minn., with dinner at 7:00 P. M. and business and technical session at 8:00 P. M. Secretary-Treasurer, Robert L. Buckley, c/o Industrial Chemical & Equipment Co., 205 11th Avenue So., Minneapolis 15, Minn. Research Finance Committee Chairman, E. H. Lindemann, c/o Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

WATERBURY meets second Thursday of each month in Elton Hotel. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Dr. B, Cheshire, Conn.

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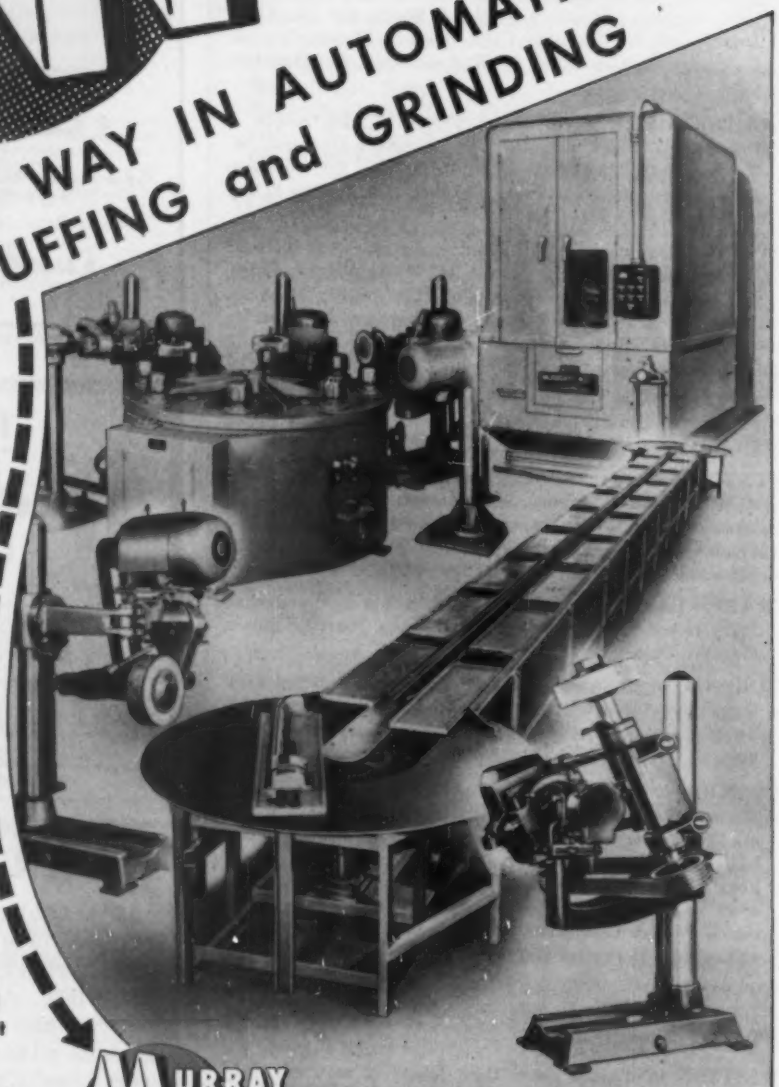

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BOSTON BRANCH, A. E. S., 17th Annual Educational Session (2:00 P. M.) and Banquet (7:00 P. M.) at the Statler Hotel on April 18, 1953.

DAYTON BRANCH, A. E. S., Annual Educational Session and Dinner-Dance at the Biltmore Hotel on April 18, 1953.

ROCKFORD BRANCH, A. E. S., 11th Annual Educational Session and Banquet at the Faust Hotel on April 18, 1953.

INDIANAPOLIS BRANCH, A. E. S., Annual Educational Session and Dinner-Dance at the Antlers Hotel on April 25, 1953.

MILWAUKEE BRANCH, A. E. S., Annual Educational Meeting (2:00 P. M.) and Banquet (7:00 P. M.) at the Schroeder Hotel on April 25, 1953.

LANCASTER BRANCH, A. E. S., Annual Meeting at the Old Mill Inn, Lancaster, on May 8, 1953.

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